Weston & Sampson SM

January 2023

Draft Comprehensive Wastewater Management Plan

MARION, MASSACHUSETTS

EXECUTIVE SUMMARY

[To Be Completed with Final Draft of Full Report]

TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION & BACKGROUND

1.1 Project Description, Drivers and Goals

Wastewater management is an important issue in Marion and is particularly notable due to the value placed on the Town's coastal waters. The significant financial investments made by the Town and property owners to address wastewater management challenges have also grown over recent years, increasing the public perception of wastewater management issues and related decision making. Marion's Select Board and Department of Public Works have been evaluating wastewater management needs and options for more than 30 years and have supported the implementation of projects to address many of the needs previously identified. The last comprehensive wastewater studies completed for the Town were the Wastewater Facilities Plan and Supplemental Comprehensive Wastewater Management Plan (CWMP), completed in 2001 and 2002, respectively. These prior studies detailed wastewater management needs of the Town at the time and projections for the Town into the future, including upgrades to the Town's Water Pollution Control Facility (WPCF) and extensions of the sewer system. Since 2002, the Town has implemented several of the recommendations of that study but has now embarked on this planning update to address needs that have continued to emerge over the past 20 years. The goals associated with this current 20-year plan for town-wide wastewater management include:

- continued environmental protection for the valuable water resources in the region,
- addressing current future permit requirements at the WPCF (either through regional or in-town solutions), and
- meeting the Town's needs through an implementable plan that is fiscally responsible.

It is through this study and Comprehensive Wastewater Management Plan (CWMP) that the Town will seek to reevaluate its wastewater management needs and outline a recommended plan for continued wastewater management for twenty years into the future. There are numerous drivers for the undertaking of this report, including (while these driving issues not necessarily listed in order of priority, some of these are being more actively engaged and managed than others at the present time):

- Continued Compliance with Regulatory Requirements – The treatment facility has generally met the historic discharge limits under normal operating conditions. However, more stringent conditions in the WPCF's National Pollutant Discharge Elimination System (NPDES) Permit, and a legal challenge from the Buzzards Bay Coalition related to the Town's continued use of the WPCF lagoon system, have resulted in significant regulatory compliance orders. Together these orders require actions by Marion, notably the need to address the existing lagoon system, other WPCF activities, reporting requirements and actions related to the ongoing Wareham wastewater regionalization evaluation and study.

- Potential Regionalization to Consolidate Wastewater Management Among Neighboring Communities –The question of possible wastewater system regionalization has become a focal point in the region. Over the past several years, one plan under consideration would centralize treatment for surrounding communities, including Marion, at the Wareham WPCF. This plan is being supported by the Buzzards Bay Coalition. The Town of Marion has been participating in the preliminary regionalization planning process. Ultimately, costs and schedule will be key issues to be considered. This CWMP offers the Town an important opportunity to assess local options for comparison to the potential regional plan and will help to provide a comprehensive and thoughtful planning process to support Marion's local decision-making.

- Growing Focus on System Resiliency – A significant part of Marion's collection system lies within the coastal flood zone, as do nearly all of the Town's wastewater pump stations. The existing conditions, along with future storm and flooding projections, present a growing threat to these facilities. The Town's recent planning efforts as a Municipal Vulnerability Preparedness (MVP) community have shown a heightened awareness of these local resiliency concerns. Protection of existing and future infrastructure investments is another key driver for this planning effort.

- Defining the Need for the Expansion of Public Sewer for Continued Resource Protection – With approximately half of the Town's developed parcels currently connected to the sewer system (public and private systems), the remainder of the improved properties rely on individual on-site (Title 5) 'septic' systems. Some of these non-sewered areas may not be best suited for long-term on-site wastewater disposal, and may contribute excess nutrients into the environment or surrounding water resources. This environmental driver for potentially extending sewers to new areas could prove to be too costly for the limited environmental benefit derived. This plan will evaluate and prioritize areas where possible extension of sewers may be appropriate.

- Rehabilitation/Modernization of Existing Infrastructure and System Capacity Restoration – As wastewater systems age, the need for repair and modernization becomes more prevalent. In Marion, the collection system is subject to significant extraneous flows from infiltration and inflow (I&I), which occasionally taxes capacity of the WPCF. The Town has been performing I&I investigation and control measures for many years, and this work has seen increased emphasis over the past two decades. The effort to reduce the impacts of I&I on the system and to preserve (and restore) treatment capacity is a main driver for this CWMP, as is the need to modernize, protect and improve systems such as the sewer pump stations.

- Sewer System Policy Considerations – The existing sewer system is made up of some areas that are served by low pressure sewers with individual grinder pumps and other areas that are served with gravity sewers. Grinder pumps that were installed under a previously SRF loan-funded contract are operated and maintained by the Town even though they are located on private property. This is difficult and costly for the Town to administer, and alternate policy decisions are another driver for this comprehensive plan. A similar difficulty exists with the private sewer systems in Town, so the policy alternatives will be reviewed from that aspect as well.

- Developing Public Awareness – Marion's unique character is notable, especially its beautiful waterfront areas. While the community likely understands the importance of protecting these natural resources, they may not be aware of the extent of the necessary wastewater management system improvements and the associated costs for providing this protection. Another important driver of the CWMP effort is developing public awareness of the needed future investments for the wastewater system components and to garner public support for implementation phases.

These project drivers will be referenced in the subsequent sections of this report, but it is clear that the known wastewater management considerations for Marion are many and varied. With these drivers in mind and the ultimate goal of providing a Town-wide roadmap for wastewater management for the next twenty years, this CWMP report includes the following:

- Documentation of the Existing and Future Conditions in the Study Area
- Needs Assessment
- Alternatives Analysis
- Recommended Plan Development
- Costs, Cost Allocation, and Project Financing
- Implementation Plan
- Public Participation Program and Input

The CWMP includes all the components required in DEP's guidance for this type of planning. Initial chapters of this report are intended to provide the reader with background information and a current snapshot of Town conditions for context in the future. The third chapter documents predictions for the future conditions over the 20-year planning period. Comparing the existing to the future to identify expected needs is captured in Chapter 4, and alternatives to meet these needs are evaluated in Chapter 5. The final chapters describe the recommended plan for future wastewater management and discuss items for future implementation of the recommendations. The main goal of this report is to provide Marion with an understanding of its existing infrastructure; alternative actions based on future projections; and the preferred actions needed to meet future demands. Other important facets of this plan are integrating public input and communicating the costs and benefits of the recommendations, such that the Town can make informed decisions about implementation plans and financing.

To determine the most appropriate solutions to Marion's wastewater management concerns, the following principles were emphasized throughout the planning process:

- Detailed, transparent, scientific-based wastewater needs information as a solid base for planning
- Thorough and thoughtful identification and review of appropriate alternatives
- Recognition of the importance of maintaining local water balance when feasible
- Selection of a recommended plan that benefits the entire Town
- Providing opportunities for public participation and stakeholder involvement

1.2 Study Area Description

The study area for this CWMP is the whole of the Town of Marion. Marion is a small, seacoast community in Plymouth County in southeast Massachusetts, approximately 45 miles south of Boston and 35 miles east-southeast of Providence, Rhode Island. It is bordered by Wareham to the north and northeast, Mattapoisett to the southwest, Rochester to the northwest, and Buzzards Bay on the east and south. According to the United States Census Bureau, the Town has a total land area of approximately 14.0 square miles and the Town boundaries encompass a number of rivers, streams and coastal waters. Figure 1-1 (attached) shows a locus map of Marion.

There are several surface waters in Marion, including the Weweantic River to the northeast and the Sippican River to the north, which together form much of the Marion/Wareham municipal boundary. Sippican Harbor is the largest coastal feature. Other noteworthy coastal waters include Aucoot Cove,

Hammetts Cove, Wings Cove, Blankinship Cove, and Planting Island Cove. These water bodies are discussed in greater detail in Section 1.2.1.3 and throughout this report. A map of the Town depicting these water bodies can be seen in Figure 1-2 (attached).

Interstate Route I-195 runs northeast to southwest through Marion, with the majority of Town located between I-195 and Buzzards Bay. Another major roadway that runs through Marion is Route 6, which is locally known as Mill Street (south/west of the intersection with Front Street) and Wareham Road (north/east of the Front Street intersection). The section of Route 6 identified as Wareham Road is sometimes referred to as Wareham Street (including in MassDOT references). Route 105, known locally as Front Street, connects Route 6 to Route I-195, and extends into Rochester.

1.2.1 *Town Hydrology and Climate*

Marion was first settled in 1679 as a village known as "Sippican," the name of the local Wampanoag tribe and meaning "the land of many waters." Water has been integral to the character and history of Marion since its founding. Marion boasts 33 miles of shoreline and inland water bodies. These waters and groundwater are all interconnected. Maintaining the health of each and all of these water resources, through thoughtful and planned wastewater management, is critical to maintain the health of this coastal community.

1.2.1.1 Buzzards Bay Watershed[1]

The entire Town of Marion is located within the Buzzards Bay watershed, which covers 434 square miles. The extent of the watershed is shown in Figure 1-3. Including Marion, the watershed is comprised of 21 communities, 11 of which are coastal and portions of two that are in Rhode Island. The watershed's namesake, Buzzards Bay, is a moderately large estuary that is 28 miles long, averages 8 miles in width, averages 36 feet in depth, and has approximately 350 miles of coastline. It is part of an interconnected hydrologic system comprised of a 700 linear mile network of small perennial streams and several notable rivers. Along the shore west of the Cape Cod Canal in Bourne, the watershed is formed by numerous small river basins and seven major river basins: the Agawam, Wankinco, Weweantic, Mattapoisett, Acushnet, Paskamanset, and Westport. These major rivers and their tributaries total approximately 100 miles in length. To the east, the watershed is primarily drained by groundwater, though several small groundwater-fed streams also drain into Buzzards Bay. Four such freshwater streams include the Back

Figure 1-3: Buzzards Bay Watershed (2013)[1]

[1] An overview of the Buzzards Bay Watershed, including methodology for determining the watershed boundary, can be found in the 2013 Buzzards Bay Comprehensive Conservation and Management Plan (CCMP) completed by the Buzzards Bay National Estuary Program (NEP).

River, Pocasset River, Wild Harbor River, and Herring Brook. Relative to the rest of the state, rivers in the Buzzards Bay Watershed are considerably shorter with smaller drainage areas.

1.2.1.2 Surficial Geology & Soil Conditions

Surficial geology provides insight to the depth to bedrock and the variation and make-up of subsurface soils, which are important factors with regard to wastewater treatment that may be expected with on-site septic systems. Prior to the last ice age, approximately 15,000 years ago, the shore and continental shelf of southern New England was periodically submerged by the ocean as glaciers advanced and retreated across the northern hemisphere. Surficial deposits that were left during the retreat of the last glacial ice sheet to cover the Buzzards Bay Basin, overlie most of the bedrock in the basin. These surficial deposits are primarily composed of till, an unsorted and unstratified mixture of clay, silt, sand, gravel, cobbles, boulders, and of stratified drift deposits. The till is overlain by stratified drift in many areas of the watershed, though the till in Marion is mostly exposed at the surface and commonly referred to as "surface till." Surface till is the most prevalent surficial geology present in Marion, with areas of coarse material (sand and gravel) particularly in the northern portion of Town as well as some salt marsh areas (floodplain alluvium) adjacent to some coastal areas. Figure 1-4 (attached) shows the General Surficial Geology found in Marion.

While soil classifications vary across Marion, Figure 1-5 (attached) shows the General Hydrologic Soil Categories. These physical characteristics of the land are critical to understanding the ability of a given area to accept wastewater and naturally treat it before it reaches the groundwater. This is of particular importance when considering on-site wastewater treatment efficacy or the need for some form of enhanced on-site or possible off-site alternatives. The highest predominance of soils in Marion is classified as Scituate-Montauk-Canton, which are typically moderately well drained. However, when these soils are thoroughly wet due to storm events, high groundwater conditions or tidal influence, a very slow infiltration rate can occur. These areas can pose a significant challenge with regard to installation and operation of a compliant on-site septic system. To overcome these challenges, on-site systems built in areas with slow infiltration often require significant amounts of soil replacement and/or mounding of systems.

The next most predominant soil group in Marion called Windsor-Merrimac-Hinkley has a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission. These soils present a potential issue for environmental protection in that they allow septic system effluent to reach the groundwater (or other resources) too quickly without adequate treatment.

Area-specific soil conditions will be further discussed regarding maintaining on-site septic systems in Section 4.

1.2.1.3 Surface Water

Marion is characterized by a number of surrounding coastal waters. A map of Marion's major surface waters is shown in Figure 1-2 (attached). There are five (5) coastal waterways in Marion and fourteen (14) sub-embayments, as listed in Table 1-1.

Table 1-1: Coastal Waterways and Sub-Embayments in Marion

Waterway	Sub-Embayment
Aucoot Cove	Hillers Cove Inner Aucoot Cove Middle Aucoot Cove Outer Aucoot Cove
Sippican Harbor	Blankenship Cove Hammetts Cove Inner Sippican Harbor Outer Sippican Harbor Planting Island Cove
Sippican River	-
Weweantic River	Inner Weweantic River Outer Weweantic River Weweantic River - Fresh
Wings Cove	Inner Wings Cove Outer Wings Cove

The Massachusetts Department of Environmental Protection (MassDEP) classifies the waters of the Commonwealth based on their intended uses. These classifications, based on a water body's designated use, inform Surface Water Quality Standards (SWQS) which further guide requirements for any discharges into these water bodies. MassDEP maintains a list of water bodies and their SWQS classifications. All of Marion's coastal (saline) surface waters are classified as SA; its inland (fresh) waters are classified as B. These two classifications, or designated uses, are defined below:

- Class B waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. These waters shall have consistently good aesthetic value.

- Class SA waters are designated as an excellent habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth, and other critical functions, and for primary and secondary contact recreation. In certain waters, excellent habitat for fish, other aquatic life and wildlife may include, but is not limited to, seagrass. Where designated in state regulation summary 314 CMR 4.00 for shell fishing, these waters shall be suitable for shellfish harvesting without depuration (Approved and Conditionally Approved Shellfish Areas). These waters shall have excellent aesthetic value.

Section 303d of the Clean Water Act requires that states identify water bodies which are not expected to meet SWQS. In accordance with this, MassDEP has identified water body segments in the state and assigned to them categories which indicate the degree to which the water body is impaired by pollutants. Each waterbody is assigned to one of the following five categories depending upon their status with respect to the support of their designated uses:

- Category 1: Unimpaired and not threatened for all designated uses
- Category 2: Unimpaired for some uses and not assessed for others
- Category 3: Insufficient information to make assessments for any uses
- Category 4: Impaired or threatened for one or more uses, but not requiring the calculation of a Total Maximum Daily Load (TMDL)

- Category 5: Impaired or threatened for one or more uses and requiring a TMDL

A description of the program, definitions of impairment categories, and the full list of impaired waters in the state can be found in the Massachusetts Year 2018/2020 Integrated List of Waters, assembled by MassDEP. Table 1-2 lists Marion's surface waters and their impairments, if any. The waterbody segments and their impairments are shown in Figure 1-6 (attached).

Table 1-2: Surface Water Body Impairments (303d list)

Water Body[1]	Description	Size (mi^2)	Class	Category
Weweantic River[3] (MA95-05)	Outlet Horseshoe Pond, Wareham to mouth at Buzzards Bay, Marion/Wareham	0.62	SA	5 Requiring TMDL[2]; Impairments for Enterococcus (TMDL No. 36172), Estuarine Bioassessments, Fecal Coliform (No. 36172), Total Nitrogen
Sippican River (MA95-06)	Headwaters, outlet Leonards Pond, Rochester to County Road, Marion/Wareham.	3.00	SA	5 Requiring TMDL; Impairments for Chlorophyll-a, Dissolved Oxygen, Enterococcus
Sippican River (MA95-07)	County Road, Marion/Wareham to confluence with Weweantic River, Marion/Wareham	0.08	SA	4a TMDL for Fecal Coliform (No. 36172)
Aucoot Cove[4] (MA95-09)	From the boundary of Division of Marine Fisheries designated shell fishing growing area BB31.1, north and southwest from Haskell Island, Marion to the mouth at Buzzards Bay demarcated by a line drawn between Converse Point, Marion and Joes Point, Mattapoisett.	0.46	SA	2 "Attaining some uses, some uses not assessed"
Aucoot Cove[5] (MA95-71)	From the confluence with Aucoot Creek, Marion to the boundary of Division of Marine Fisheries designated shell fishing growing area BB31.1, north and southwest from Haskell Island, Marion (formerly part of segment MA95-09).	0.03	SA	5 Requiring TMDL; Impairments for Dissolved Oxygen, Fecal Coliform (TMDL No. 36172), Total Nitrogen, Nutrient/ Eutrophication Biological Indicators
Aucoot Creek (MA95-72)	Estuarine portion east of Holly Pond Road, Marion to confluence with Aucoot Cove, Marion.	0.02	SA	5 Requiring TMDL; Impairments for Dissolved Oxygen, Fecal Coliform (TMDL No. 36172), Total Nitrogen, Nutrient/ Eutrophication Biological Indicators
Hammetts Cove (MA95-56)	Borders Sippican Harbor (along a line from the southwestern most point of Little Neck to the end of the seawall on the opposite point), Marion.	0.07	SA	5 Requiring TMDL; Impairments for Estuarine Bioassessments, Fecal Coliform (TMDL No. 36172), Total Nitrogen
Sippican Harbor (MA95-69)	The waters between a line demarcating the mouth of the harbor (from Converse Point to Butler Point, Marion) and a line from Allens Point, Marion around the southeastern tip of Ram Island, then westerly from the southern tip of Ram Island, to the point of land south of Nyes Wharf, Marion excluding Blankenship Cove and Planting Island Cove (formerly reported as a portion of segment MA95-08).	1.94	SA	2 "Attaining some uses, some uses not assessed"
"Inner" Sippican Harbor (MA95-70)	The waters landward of a line from Allens Point, Marion around the southeastern tip of Ram Island, then westerly from the southern tip of Ram Island to the point of land south of Nyes Wharf, Marion excluding Hammett Cove (formerly reported as a portion of segment MA95-08).	0.57	SA	5 Requiring TMDL; Impairments for Estuarine Bioassessments, Fecal Coliform (TMDL No. 36172), Total Nitrogen, Nutrient/ Eutrophication Biological Indicators

Water Body[1]	Description	Size (mi²)	Class	Category
"Unnamed Tributary" (MA95-80)	Unnamed tributary to Aucoot Creek, headwaters west of Mill Street (Route 6), Marion to the Marion WPCF (MA0100030) discharge, Marion.	0.30	B	2 "Attaining some uses, some uses not assessed"
"Unnamed Tributary"[6] (MA95-81)	Unnamed tributary to Aucoot Creek from the Marion WPCF (MA0100030) discharge, Marion to the boundary of the saltwater wetland, Marion.	0.70	B	2 "Attaining some uses, some uses not assessed"

Notes: [1] The Water Body descriptions in this table are from the impaired waters identified in the MassDEP 303d list.
[2] TMDL = Total Maximum Daily Load.
[3] This includes all Weweantic River segments identified in Table 1-1.
[4] This generally includes the middle and outer Aucoot Cove areas identified in Table 1-1.
[5] This is generally part of inner Aucoot Cove identified in Table 1-1.
[6] This is the "Unnamed Brook to Aucoot Cove" as referenced in the NPDES permit for the Marion WPCF.

Of particular importance is the "Unnamed Tributary to Aucoot Cove" (MA95-81), occasionally called "Effluent Brook", and sometimes referred to as "Giffords Brook", the stream into which Marion's WPCF effluent discharges. This is the "Unnamed Brook to Aucoot Cove", as referenced in the NPDES permit for the Marion WPCF. This unnamed tributary itself discharges into the saltwater wetlands of Aucoot Cove (that is Inner Aucoot Cove, which includes the impaired segment MA95-71), a waterbody with impairments for dissolved oxygen, fecal coliform, Total Nitrogen, and nutrient/eutrophication biological indicators. The impairments of this waterbody, downstream from Marion WPCF's effluent discharge, inform the requirements of the WPCF's permitting and treatment limits. On-site systems also affect surface water quality through the movement of leaching field discharges to the groundwater and its interfaces with surface waters.

In addition to water quality assessment and categorizing performed by MassDEP for the Massachusetts Year 2018/2020 Integrated List of Waters, as presented in Table 1-2 above, other sampling programs and water quality assessments for Marion's surface waters have been performed over the past couple of decades (and continue to be today) to further document changes in parameters such as Total Nitrogen, Dissolved Oxygen, Algal Pigments, and Water Clarity. These sources were referenced as part of this CWMP effort to denote information analyzed.

Surface waters in Marion are integral to the fabric of the community. Marion has strong ties to its waters through its extensive coastline, marine habitats, Town beaches, and recreational activities. Marine businesses and boating make up an important segment of the Town's economy and culture. As such, the Town and community groups are dedicated to the protection of its surface waters. Effective wastewater management, through treatment standards at the WPCF and management of on-site treatment systems, is a powerful tool for the protection of these valuable water resources.

1.2.1.4 Aquifers & Water Supply

Marion's water supply originates from two major groundwater sources, an aquifer west of the Route 195 and Route 105 interchange in Marion and bordering Rochester, and an aquifer which underlies the Mattapoisett River Valley, from Snipatuit Pond in Rochester to the Harbor in Mattapoisett. These aquifers are protected by delineation of Zone I and Zone II recharge areas and associated land use restrictions in these areas. Marion's Aquifer Protection and Water Supply Districts overlay the Zone I and Zone II protection areas, respectively. These protective zoning overlay districts are further described in Section 12.1. The Town of Rochester similarly has a Groundwater Protection District which includes Zone I and Zone II protective areas around their groundwater wells and restricts land use in these areas. It is

important to understand the restrictions in these areas as they inform the feasibility of installing and maintaining effective on-site wastewater treatment systems.

Six of Marion's seven well locations are in Rochester. Marion's Main Water Station, the Town's oldest wellfield in operation, is located in Marion. A Water Agreement originally effective in 1970, renewed in 2018, and currently effective through 2038 between Marion and Rochester, gives the Town of Rochester the right to connect to Marion owned infrastructure located in Rochester, so long as the supply of water to Rochester does not exceed 50 percent of Marion's total supply. Table 1-3 provides a list of wells used by the Town and their current operational status. A map depicting the approximate aquifer areas is shown on Figure 1-7 (attached).

Table 1-3: Town of Marion Water Supply Well Sites

Name	Location	Description	Operational Status
Mary's Pond Road Wellfield	Rochester	25 2½" tubular wells	Undergoing rehabilitation
(Route 105) East Well	Rochester	12"x18" gravel packed well	Offline since 2009
(Route 105) West Well	Rochester	12"x18" gravel packed well	Offline since 2009
Main Water Wellfield	Marion	29 2½" tubular wells	In use
Wolf Island Road Well	Rochester	24" gravel packed well	In use, contributes to MRVWD
New Bedford Road North Well (Perry Hill)	Rochester	12"x18" gravel packed well	In use
New Bedford Road South Well (Perry Hill)	Rochester	12"x18" gravel packed well	In use

Marion also has a water supply interconnection with the Mattapoisett River Valley Water District (MRVWD) through the Town of Mattapoisett. An agreement between Marion and the MRVWD stipulates that Marion may not exceed 0.60 MGD (an average withdrawal of 416 gallons per minute, gpm). Marion draws an average of 0.25 to 0.29 MGD (180 to 200 gpm) of water from the interconnection according to a 2020 Water Distribution Study (Draft) conducted by Tata & Howard.

As discussed in subsequent sections of this report, Copper is a contaminant of concern at the WPCF. While there are numerous methods for reducing copper in the WPCF, many of which are discussed in detail in this report and prior reports, one important method involves the treatment of Marion's drinking water prior to distribution. Managing the pH of the drinking water using chemical additions can mitigate corrosion of copper pipes and reduce copper loading at the WPCF from homes connected to the sewer. It is important to understand how water supply and wastewater quality can influence one another.

1.2.1.5 Climate and Precipitation

The National Weather Service (NWS) has three climatological stations in the Buzzard Bay Watershed that collect and compile weather data for the National Oceanic and Atmospheric Administration (NOAA): East Wareham, New Bedford, and Rochester. Data for precipitation and temperature from the Rochester station, which had the fewest instances of incomplete data for the years 1952 through 2020, is presented in Figures 1-8 through 1-11 below. The Rochester station is approximately seven miles northwest of the nearest Marion Town boundary.

Between 1952 and 2020, average annual precipitation ranged between 28 inches and 73 inches. July is, on average, the driest month when precipitation averages less than 3.7 inches. December and March are the wettest months when precipitation averages approximately 4.9 inches. Average annual snowfall is about 37 inches. Precipitation has historically been fairly uniformly distributed throughout the year as seen in Figure 1-9. Precipitation is also measured at the WPCF. For years in which the WPCF data is available, the precipitation follows the trend seen at the Rochester station, though averages show up to 30% less precipitation at the WPCF. Given that precipitation varies with increased distance from the coast, this discrepancy between weather stations is not surprising.

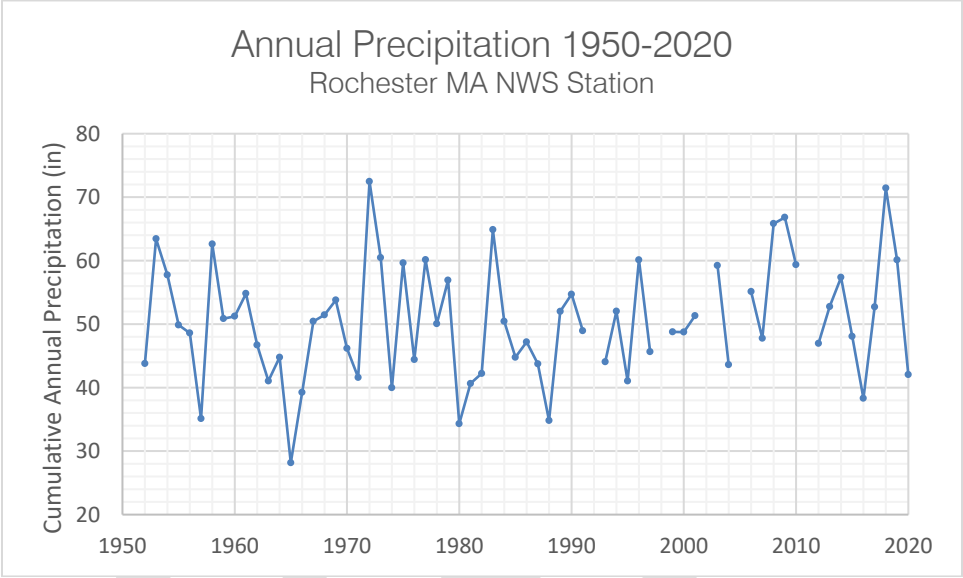

Figure 1-8: Average Annual Precipitation for Rochester MA NWS Station, 1952-2020

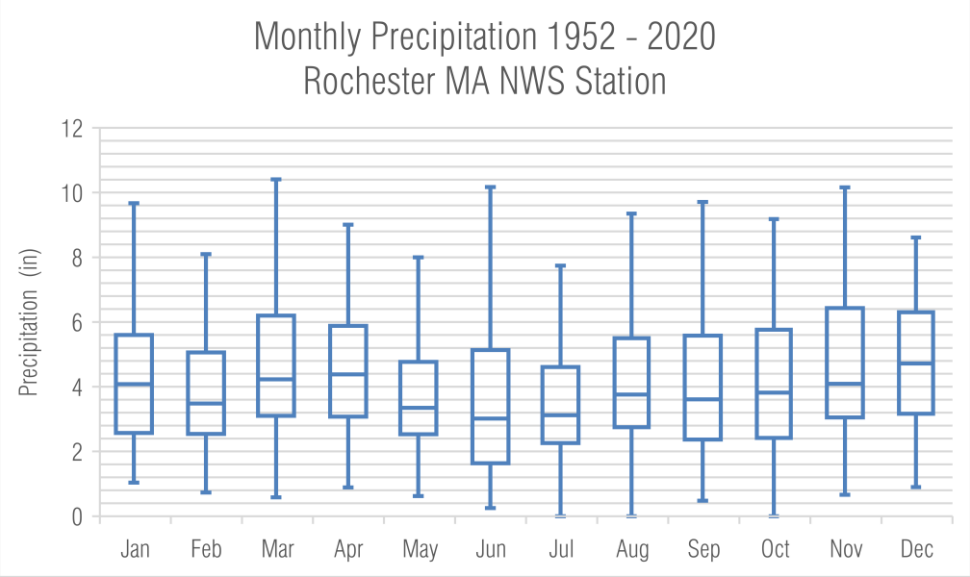

Figure 1-9: Monthly Precipitation Data for Rochester MA NWS Station, 1952 – 2020

Precipitation is important to evaluate as part of this CWMP effort because it unintentionally reaches the sewer system infrastructure and impacts capacity available for wastewater (versus stormwater) flows. Rainfall that permeates into the ground can enter into below-grade sewer pipeline (infiltration) where joints are no longer water-tight (as can be the case with older infrastructure). Similarly, property owners that experience flooding from storm events may have connections from building sump pumps or drainage systems tied into the sewer system (inflow). Such connections are not allowed in Marion. These extraneous flows, inflow & infiltration (I&I), do not require the same treatment as wastewater but use capacity in the pipeline and pump stations that is needed for true wastewater and leads to unnecessary treatment of these extraneous flows at the WPCF. Town staff has observed that the WPCF is particularly affected by high flows when there are multiple significant storm events within a short time span.

Between 1952 and 2020, mean annual temperature ranged from 46.5° F and 53.5° F (degrees Fahrenheit). The lowest mean monthly temperature ranges from 17.4° F to 36.8° F during January, and the highest mean monthly temperature ranges from 66.1° F to 76.7° F during July (based on data for the years 1952 through 2020).

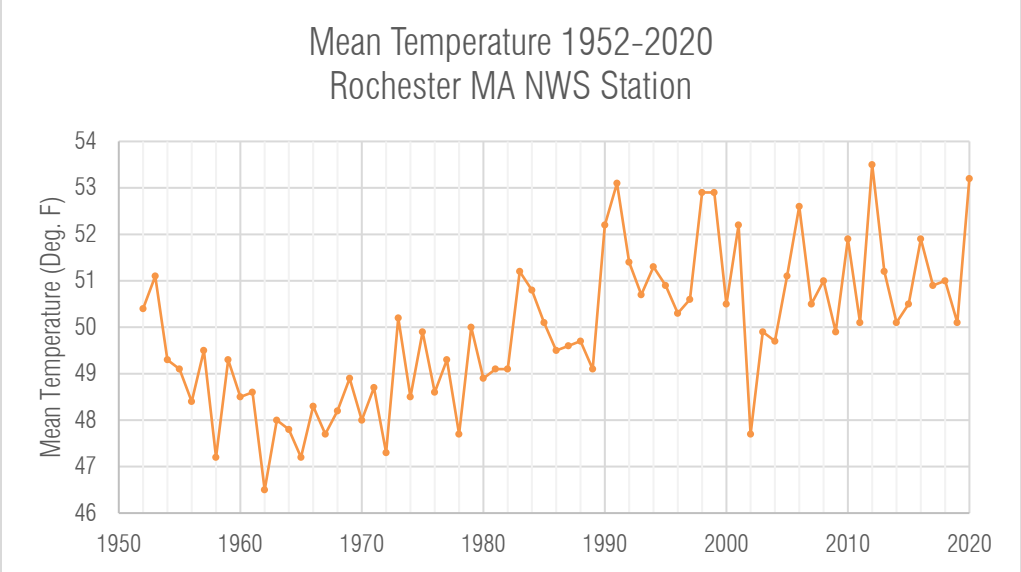

Figure 1-10: Mean Annual Temperature for Rochester MA NWS Station, 1952 – 2020

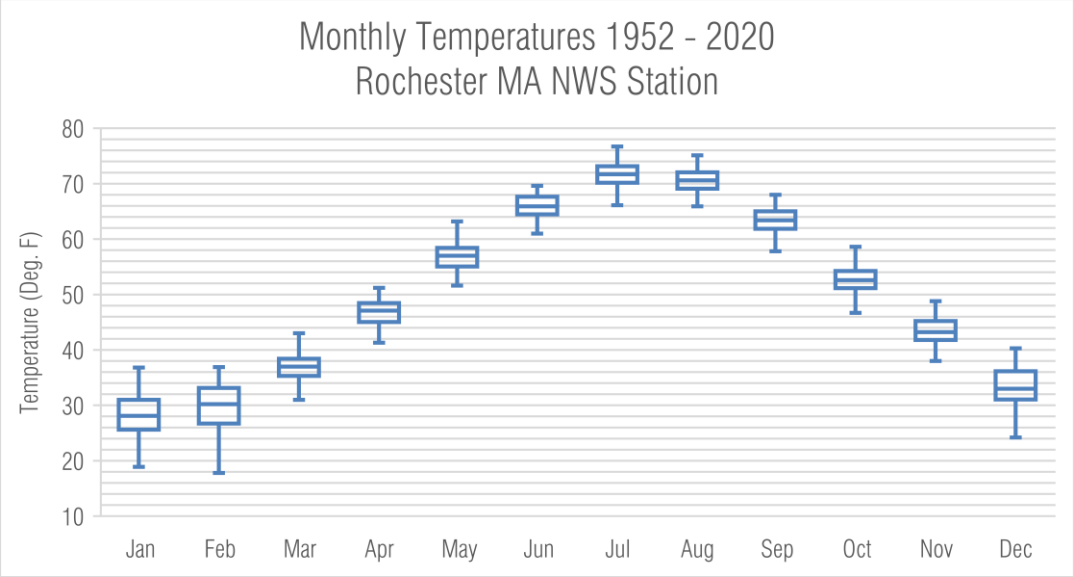

Figure 1-11: Monthly Mean Temperature for Rochester MA NWS Station, 1952 – 2020

Climate changes are an important factor in evaluating infrastructure resiliency; this is especially true in Marion with the extensive coastline and many topographically low-lying areas. The existing sewer system continues to experience negative impacts due to various storm events, so evaluations of precipitation trends are important to confirm that the future wastewater system capacity is sufficient through the planning period and beyond.

1.2.2 *Organizational Context*

Marion's government consists of a Select Board (SB) and a Town Administrator. The SB consists of three elected officials who serve as the public representatives for the Town's legislative and policy-making body. They approve budgets, establish community goals, and strategize long-term plans. The SB also serve as the Board of Water and Sewer Commissioners. The Board is responsible for decision-making to maintain the water supply system for the Town and to operate and maintain the central wastewater collection, treatment and disposal system. The Town Administrator works under the direct supervision of the SB to set the strategy of the Town in accordance with SB directives, set overall operating goals for the Town, and oversee the administration of Town government.

The Marion SB, acting as Board of Water and Sewer Commissioners, has taken the lead role in this interdepartmental wastewater management planning effort. The Marion wastewater system has undergone numerous changes in the past two decades, and the treatment system began its most recent major upgrade in 2020. Marion's Department of Public Works includes a separate Water Division, which is responsible for managing the Town's municipal water supply system. Marion's Sewer Division, an entirely separate division within the Department of Public Works, is responsible for managing the Town's sewer collection and treatment system.

Several other governmental bodies are integral to the comprehensive management of wastewater in the Town. The Planning Board and Zoning Board of Appeals review developments proposed for the Town, including issues relating to land use, flood plain and groundwater conservancy areas, zoning, and housing. The Planning Board is authorized under the General Laws of Massachusetts to regulate the laying out and construction of ways in subdivisions to ensure the safety, convenience, and welfare of

present and future inhabitants of Marion. The Planning Department maintains planning-related information for the Town and makes that data available for the general public.

The Board of Health is charged with protecting the health, safety, and well-being of all community members against infectious disease threats, substandard living conditions, and environmental hazards. As such, it is responsible for reviewing and permitting individual household and business wastewater disposal systems. The state's environmental code, Title 5, serves as the basis for regulating these systems. Board of Health staff play a vital role in this wastewater planning, through involvement at the staff level. The Board's files are vitally important in establishing the baseline of data for the suitability analysis of parcels in Town for on-site treatment systems.

The Conservation Commission is responsible for the administration of the State Wetlands Protection Act and overall stewardship of the natural resources of the Town, as well as the establishment of Town environmental policies in conjunction with the SB.

1.2.3 *Town Development and Infrastructure*

The Town of Marion is predominantly residential. A significant portion of land is undeveloped, due mainly to conservation or other land use restrictions. Commercial and industrial development in Town has undergone limited growth, focused mainly in the downtown area and along Route 6. Marion is located within the Southeast Regional Planning & Economic Development District (SRPEDD). Further discussion of existing development in Marion can be found in Section 2.1.

To accommodate existing Town development, municipal infrastructure includes a centralized sewer system, which provides wastewater collection, treatment and disposal for more than half of the developed parcels in the Town. Wastewater that is collected by the centralized sewer system is transported to the Marion WPCF for treatment, with discharge of final effluent to a tributary of Aucoot Cove. That facility operates under a federal surface water discharge permit (NPDES Permit MA 0100030). The remaining unsewered developed parcels in Marion have on-site (septic) systems for wastewater management. While there are no private wastewater treatment systems in Marion, several neighborhoods have private sewer, flow from which is ultimately discharged to the public sewer system for treatment at the WPCF. Figure 1-12 (attached) shows the location of wastewater system infrastructure in Marion.

Nearly all developed parcels in Marion receive municipal drinking water service from the Marion Water Division. The Town has a well-developed water supply, storage and distribution system. The Town also has a separate storm drain system to convey stormwater flows from roadways and other local developed areas to designated outfalls. Marion is a designated MS4 (Municipal Separate Storm Sewer System) community under the NPDES Phase II Stormwater Program. As part of efforts to remove extraneous flows from the sewer system, the Town has, in the past, allowed identified inflow sources (mainly from sump pumps) to be re-directed to the storm drain system, as appropriate. Extraneous flow removal from the sewer is important to control treatment costs at the WPCF. At some point in the future, the drainage system will likely need evaluation and possible upgrades to address system resiliency. Future stormwater/drainage system planning should include additional capacity considerations for identified or suspected inflow sources that are currently connected to the sewer system.

1.3 Prior Planning Efforts

The Town of Marion and several regional planning groups have been active in developing numerous documents related to the environmental health, economic development, and infrastructure management for the Town. Relevant information and findings from these planning efforts have been incorporated into this CWMP, as appropriate. Below is a list and date of completion of major, relevant planning documents used in the preparation of this report. This list is followed by general descriptions of the referenced documents.

- Wastewater Facilities Plan (2001) and Supplemental CWMP (2002)
- Water & Sewer Rate Study (2007)
- Copper Optimization Engineering Report (2011)
- Housing Production Plan (2015)
- Phase IV – Sewer System Evaluation Survey (SSES) Report Update Including Results of the East Marion Field Program (2016)
- Town of Marion Wastewater Treatment Plant Outfall Alternatives – Analysis of Alternatives (Draft 2016)
- Master Plan for the Town of Marion, Massachusetts (2017)
- Aucoot Cove Sewer Evaluation (2017)
- Reporting Related to 2017 NPDES Permit (2017 – Present)
- Development of Estimated Costs for Marion Wastewater Conveyance to Wareham WPCF (2018)
- Lagoon Optimization Plan (2018)
- Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure (2019)
- Collection System Operation and Maintenance (O&M) Plan: Phase 2 (2019)
- Town-Wide Sewer Investigation & Improvement Program (2020)
- Town of Marion Safety Report (Draft 2020)

1.3.1 *Wastewater Facilities Plan (2001) and Supplemental CWMP (2002) by CDM (now CDM Smith)*

The last comprehensive study of Marion's wastewater infrastructure and management was completed in 2001 and supplemented in 2002. As is typical, this Facilities Plan was written for a 20-year planning period. Since 2001, much of Marion's wastewater treatment system conditions and needs have changed.

To accommodate predicted growth and increased treatment needs, the 2001 Facilities Plan recommended extending sewer to 580 properties in the following three needs areas:

- Berry Roads section of north Front Street
- Dexter Beach
- South section of Converse Road

Four other areas were identified as possible needs areas in this prior effort. Three of these areas were determined to need no action at the time: northern section of Front Street (north of Berry Roads area), Planting Island, and the Indian Cove Road area. The fourth area, Old Knoll Road, was provided access to the sewer system via a then new private sewer line.

A sewer extension project completed after the 2001 Wastewater Facilities Plan provided connections to the sewer system for the bulleted areas above, as recommended in the 2001 Facilities Plan. Remaining unsewered areas adjacent to the Berry Roads, Dexter Beach and Converse Road needs areas have been evaluated as needs areas in this current CWMP and are discussed in greater detail in later sections.

A factor that drove the 2001 evaluation of the treatment needs at the WPCF was compliance with the (then current) NPDES permit. At the time, the WPCF treatment process included only lagoon treatment, sand filtration and disinfection. As such, the facility was having trouble consistently meeting permit limits, and was also approaching its permitted capacity. In addition, to address discharge permit requirements, the disk filters were being installed to replace the sand filtration. The recommended plan for WPCF improvements at that time included adding the following:

- Aeration (aerators and blowers) in the lagoons
- Screening and grit removal facilities
- pH control (soda ash) system
- 2 sequencing batch reactors (SBRs) with diffused air aeration
- Equalization tank following the SBRs

As summarized in Table 1-4, other treatment alternatives were considered in the 2001 evaluation, prior to the selection of the recommended plan. The SBR process train was selected for its highly reliable nutrient and organics removal; future expansion and operational flexibility; and no needs relating to return activated sludge (RAS) pumping or primary treatment.

In October 2002, an Environmental Notification Form (ENF) for upgrades to the WPCF and sewer extensions, as recommended by the 2001 Facilities Plan, was submitted for review under the Massachusetts Environmental Policy Act (MEPA).

Table 1-4: 2001 Facilities Management Plan Liquid Treatment Alternatives

Treatment Step		Process Alternative	Selection
Preliminary Treatment	Screening	Hand Cleaned Bar Racks	
		Mechanically Cleaned Screens with Bar Racks	✓
	Grit Removal	Aerated Grit Chamber OR Centrifugal Grit Chamber	✓
		Cyclone Primary Sludge Degritter	
Secondary Treatment	Nutrient and Solids Removal	Velocity- Controlled Channels	
		Conventional Activated Sludge	
		Biological Aerated Filters	
		Oxidation Ditches	
		Rotating Biological Contactors	
		Sequencing Batch Reactors and Equalization Tanks	✓
	Clarification	Circular Clarifiers	
		Rectangular Clarifiers	
Residuals Management	Holding Facilities	Storage in Aerated Lagoons	✓
		Holding Tanks	
	Dewatering Facilities	Belt Filter Presses	
		Centrifuges	
		Sludge Drying Beds	
	Disposal	Offsite Incineration	
		Lime Stabilization and Sanitary Landfilling	
		Lime Stabilization and Sludge Only Landfilling	
		Composting	

1.3.2 *Water & Sewer Rate Study (2007) by Tata & Howard Inc.*

The *Water & Sewer Rate Study* written by Tata & Howard Inc. in November 2007, reported findings regarding then current and future water and sewer rates for the Marion Department of Public Works (DPW). Tata & Howard studied the billing practices of 2007 and the estimated future expenditures to determine a new rate structure. The water and sewer rates were evaluated for a 5-year period, and it was determined that Marion's existing ascending block rate billing system was adequate. Several minor modifications were also recommended.

1.3.3 *Copper Optimization Engineering Report (2011) by CDM Smith*

The *Copper Optimization Engineering Report* was prepared by CDM Smith in August 2011 in response to the requirements of a 2007 Copper Administrative Order (2007 Order) issued by US EPA. The 2007 Order, which is described in greater detail in Section 2.5, cites the Marion WPCF for violations of the copper limitations included in its then effective NPDES Permit.

The *Copper Optimization Engineering Report* consists of the following sections:

- Historical Copper Data
- WPCF Copper Sampling Program

- Water Supply Evaluation
- Evaluation of Collection System Discharge (including a list of industrial and commercial users)
- WPCF Copper Control Strategies
- Recommended Plan for Controlling Copper

The Recommended Plan for copper optimization was divided into three phases. These phases and their status since 2011 are presented in Table 1-5:

Table 1-5: Copper Optimization Report – Recommended Plan Phases

Phase	Recommendation	Status
1	Conduct a pilot program to modify sludge disposal operations at the WPCF	In 2013, the Town modified the sludge handling operation with the goal of sequestering copper. Sludge discharge modification to a single lagoon was attempted but was not successful due to inoperable valves. Efforts to modify the handling of solids are being addressed in an ongoing lagoon optimization program (which is described in greater detail in Section 2.4 of this CWMP).
2	Develop a local copper limit with monitoring	Since 2011, the Town has implemented field sampling programs and adopted a revised sewer use regulation. The revised sewer use regulations included a local copper limit as well as an industrial user section that includes items associated with EPA's industrial user pretreatment program to address industrial discharges and copper to the system. This regulation was promulgated in 2014 and is discussed in greater detail in Section 2.1.4.
3	Waste activated sludge thickening	Efforts to modify the handling of solids are being addressed in an ongoing lagoon optimization program which is described in greater detail in Section 2.4. This approach is consistent with the recommended approach of Phase 1 above.

Consistent with the requirements of the 2007 Order, Annual Copper Optimization Reports have been prepared since 2011. Those reports include summary information on the status of compliance, including Marion's efforts to meet the recommendations put forth by the 2011 Copper Optimization Engineering Report for each calendar year. These annual status reports were also reviewed in the development of this CWMP.

1.3.4 *Housing Production Plan (2015) by the Marion Affordable Housing Trust*

Marion's *Housing Production Plan* (HPP), completed in 2015, outlined a proactive strategy for meeting the housing needs of the community and for planning and developing affordable housing. The HPP identified six major goals for the Town to create a mix of housing types sufficient to meet projected needs, demands, and community preferences. These goals are as follows:

1. Increase the proportion of housing types suited to the major emerging demographics of smaller households and elderly households.
2. Create more "workforce" housing options for underrepresented demographics in Marion such as young families and similar household types including first-time home buyers.
3. Ease cost burdens for existing homeowners.
4. Increase housing options for municipal employees.
5. Promote affordable housing in mixed-use village style nodes.
6. Increase the number of subsidized affordable housing units eligible for inclusion on the Subsidized Housing Inventory.

In general, the HPP recommended increased housing development but acknowledged that an increase in housing would create an increased burden on existing infrastructure, including the Town sewer system. The HPP, and other community planning documents referenced therein, stated a clear preference for new development to utilize municipal water and sewer connections. It urged prioritizing the location of future housing units to facilitate connection to the public sewer system and limit the addition of new septic systems to help protect water quality.

1.3.5 *Phase IV – Sewer System Evaluation Survey (SSES) Report Update Including Results of the East Marion Field Program (2016) by CDM (now CDM Smith)*

Prior to the development of the current Annual I&I Program, the Town had a 4-phased Sewer System Evaluation Survey (SSES) that spanned from 2003 through 2018. CDM completed an update report in 2016 which detailed the work completed during that SSES and is summarized as follows:

- Phase 1: Flow isolation in the Village Area and East Marion sewers at approximately 35 locations. The flow isolation results indicated that approximately 75% of the Town's I&I originates from the Village Area. This led to more focused flow isolation program in the Village Area that identified approximately 49,000 linear feet (lf) of sewer for future inspection.

  A building inspection program was conducted in the Village Area to identify private inflow sources. This program inspected 146 buildings and identified 13 private inflow sources.

- Phase 2: Using the data from Phase 1, a targeted SSES investigation was performed in the Village Area. This investigation included the inspection of approximately 17,000 lf of sewer and 200 sewer manholes.

- Phase 3A: This phase included the construction of structural repairs recommended as part of Phase 2 of this SSES. In total, approximately 2,000 lf of sewers were replaced via excavation.

- Phase 3B: This phase included multiple projects. Additional structural repairs were identified and completed during this phase. In total, approximately 180 lf of sewers were replaced via excavation and an additional 1,300 lf of trenchless repairs were performed as part of the construction project.

  The Sewer Use Ordinance was updated as part of this Phase. It was updated using recommended changes to allow the Town to identify and remove private I&I sources more effectively and also to implement regulations regarding Fats, Oils and Grease (FOG).

  A building inspection and dye testing program was conducted in the Village Area to identify private inflow sources. This program inspected 673 properties and identified 42 private inflow sources. In addition, as part of this program 14 of those private inflow sources were removed.

- Phase 1A: This phase included construction of repairs recommended as part of Phase 1. Approximately 1,200 lf of sewers were repaired using trenchless technologies. In addition, 23 stormwater lateral connections were brought to the property line of properties that have private inflow sources to potentially connect to in future projects.

- Phase 4: Flow isolation in the Village Area and East Marion sewers at approximately 44 locations. The flow isolation results indicated that approximately 74% of the Town's I&I originates from the Village Area. This led to more focused flow isolation program in the Village Area that identified approximately 49,000 linear feet (lf) of sewer for future inspection.

  A targeted SSES investigation was performed in the Village Area and East Marion. This investigation included the inspection of approximately 58 sewer manholes. In addition, television inspections were limited to East Marion and included seven Sewersheds.

  A building inspection and dye testing program was conducted in the Village Area to identify private inflow sources. This program inspected 36 properties and observed 3 private inflow sources.

Significant improvements to the collection system were made during this time period and much of the information gathered during these investigations has been used to inform ongoing work and plan the Annual Program described in Section 1.3.14 and elsewhere in this report.

1.3.6 *Town of Marion Wastewater Treatment Plant Outfall Alternatives (2016) by CDM (now CDM Smith)*

Written in May 2016 by CDM Smith, this memorandum outlines the development and evaluation several potential alternatives to Marion's WPCF current discharge location. The evaluation was conducted in response to stricter Draft National Pollutant Discharge Elimination System (NPDES) Permit conditions, including the reduction of total nitrogen (TN), total phosphorus (TP), and total copper. By moving the outfall location and thus changing the receiving water of the discharge, it was suggested that the WPCF might be able to avoid more costly process upgrades at the plant. The two general categories of alternatives that were evaluated included the following:

- Extending the existing outfall pipe to discharge at the head of the saltmarsh that fronts Aucoot Cove, thereby potentially eliminating TP permit limits by bypassing the fresh waters of Effluent Brook, Giffords Brook, or "Unnamed Tributary" (MA95-81)

- Extending the existing outfall pipe into Outer Aucoot Cove, thereby potentially eliminating both TP and TN permit limits and possibly reducing or eliminating copper limits by discharging to deep waters in Aucoot Cove

Cost information provided in this report suggested that all options were costly to construct. No alternative was selected from this evaluation, though both were determined to be feasible based on a preliminary assessment.

1.3.7 *Master Plan for the Town of Marion, Massachusetts (2017)*

Marion's *Master Plan* was developed between 2014 and 2017 by Marion's Planning Board and the regional planning agency, Southeastern Regional Planning and Economic Development District (SRPEDD). The vision of the plan was to "use historical information, public participation, current socioeconomic and demographic data, and anticipated future challenges to identify guiding principles that will protect Marion's traditional seaside character and natural resources while managing change."

Several previous planning documents were utilized in the development of the 2017 Master Plan. These documents are as follows:

- Marion Master Plan (1974)
- Marion Land Use Plan (1998)
- Marion Growth Management Committee's Status Report of Planning Recommendations (1996)
- Marion Open Space and Recreation Plan (1998)
- Marion 2015 Plan (2005)
- Marion's Priority Area Update Report (2013)

The 2017 *Master Plan* identified major goals for development, many of which the Town has already begun exploring, including Services and Facilities Goal 6.1: Work to Establish Sufficient Capacity in the Wastewater Treatment System to Support Growth. Current limited sewer capacity was identified as an impediment to current and future economic development and mixed-use growth. The following strategies to achieve this goal were described:

- Prioritize the correction of sewer I&I issues (estimated at approximately 300,000 gallons per day).
- Upgrade the current WPCF to reach higher levels of treatment for total nitrogen, total phosphorus, copper, and total suspended solids.
- Line the current settling basins (lagoons) to halt potential groundwater contamination.
- Explore options for decentralized placement of alternative, biologically based treatment technologies.
- Participate in Buzzards Bay Coalition study investigating the feasibility of regionalizing wastewater treatment for the communities of Marion, Wareham, South Plymouth, Bourne, and the Mass Maritime Academy.
- Work with Mattapoisett to sewer Indian Cove Road area in Marion and Harbor Beach in Mattapoisett to reduce nitrogen loading into Aucoot Cove.
- Position the Town for participation in the MassDEP Clean Water State Revolving Fund (SRF) Program for Wastewater Treatment Plant upgrades.

It should be noted that since 2017, the Town has begun efforts in each of these strategy areas, as will be discussed in later sections of this report.

The *Master Plan* targeted several locations for priority development. The existing Sippican Office park (upland area within and abutting the Park) and other appropriate vacant and utilized locations along Route 6, were identified for large scale future commercial and industrial development. Areas identified for mixed-use future development were (1) the Routes 6 and 105 Gateway, (2) the Point Road Commercial Area, and (3) Marion Village. Achieving growth in any of these areas would have ramifications for Master Plan Goal 6.1 to establish capacity within the wastewater treatment system.

1.3.8 *Aucoot Cove Sewer Evaluation (2017) by CDM Smith*

The Aucoot Cove Sewer Evaluation – Preliminary Design memorandum was written in June 2017 by CDM Smith. In this memorandum, CDM Smith evaluated the feasibility of extending sewer to the Indian Cove and Harbor Beach area neighborhoods. The evaluation was completed in partnership with the Town of Mattapoisett and the Buzzards Bay Coalition (BBC) under a Southeast New England Program – Water Quality Management Grant (SNEP) from the Massachusetts Executive Office of Energy and Environmental Affairs, Office of Coastal Zone Management.

According to the evaluation, these neighborhoods of Indian Cove in Marion and Harbor Beach in Mattapoisett consist of approximately 158 homes and discharge approximately 5,300 pounds of nitrogen per year to Aucoot Cove. A capacity assessment of Marion's WPCF was included. It was determined that to meet Marion's 2017 NPDES permit, the WPCF could only accommodate an additional 78 residential connections. Therefore, it was deemed feasible to extend sewer to only Indian Cove. It was suggested that the WPCF might extend its outfall to the head of the saltmarsh at Aucoot Cove to work around the phosphorus limits of the NPDES permit. That action would make it feasible to extend sewer to both neighborhoods.

Neither neighborhood has been connected to sewer since the writing of 2017 Aucoot Cover Sewer Evaluation. However, the Indian Cove neighborhood has been included in the Aucoot Creek Needs Area in this current CWMP effort. A detailed discussion of Aucoot Creek Needs Area can be found in Section 4.1.2 of this report.

1.3.9 *Reporting Related to 2017 NPDES Permit (2017-present) by Marion WPCF Staff & CDM Smith*

The currently effective 2017 NPDES Permit for the Marion WPCF included annual reporting requirements. These reports, presented below, were reviewed in the development of this CWMP:

- Biosolids Report
- Collection System O&M Report
- 80% Flow Report (Annual, if 12-month rolling average flow exceeds 80% of design capacity)

A detailed review of the regulatory requirements of the Town, including discussion of NPDES Permit and its reporting requirements, is included in Section 2.4.

1.3.10 *Development of Estimated Costs for Marion Wastewater Conveyance to Wareham WPCF (2018) by GHD*

As part of evaluating the regional alternative, the *Development of Estimated Costs for Marion Wastewater Conveyance to Wareham Water Pollution Control Facility (WPCF)* memorandum was written by GHD in November 2018. Based on regulatory pressures and input from the BBC, the neighboring Town of Wareham approached Marion, as well as other abutting towns and major facilities to determine the feasibility of regionalizing wastewater treatment at the Wareham Water Pollution Control Facility. For Marion to divert all of its sewer flow to the proposed future regional system at Wareham, it is proposed that Marion would install a pipeline from its Front Street Pump Station to a discharge point in Wareham. This memorandum discusses the estimated cost related to installing a new sewer force main to pump the Town of Marion's wastewater from Front Street Pump Station to the Town of Wareham's sewer infrastructure. GHD identified the following three force main routing and connection options, the third of which was determined to be most feasible based on estimated costs:

- Connection to the 21-inch receptor on Burr Parkway
- Connection to the Narrows Pump Station
- Direct connection to the Wareham Water Pollution Control Facility

The approximate total cost for the direct connection conveyance option provided in this memorandum was estimated to be $22.6 million, in 2018 dollars. This represents a preliminary estimate of transmission cost from the existing Marion sewer system only, not any cost for treatment at the Wareham WPCF or sewer extensions to unsewered areas of Marion. Different components of the regional alternative, including total cost are still to be determined, as conveyance to the Wareham system is only a portion of those costs. Available information on the regional alternative is included for analysis in later chapters of this CWMP. However, the timeline for finalization of and commitment to a regional solution will extend beyond the completion of this CWMP report.

1.3.11 *Lagoon Optimization Plan (2018) by CDM Smith*

The *Lagoon Optimization Plan* was written by CDM Smith in August 2018 in response to the requirements of a 2017 Administrative Order on Consent (AOC). The Lagoon Optimization Plan includes a detailed engineering assessment of the WPCF hydraulic operation constraints, a forecast of influent flows to the WPCF, and mass-balance model of lagoon operations. The plan also includes the following recommendations:

- Modify SBR control programming to increase hydraulic capacity and allow normal operation of single SBR
- Disk filter upgrade
- Line Lagoon 1 and make associated upgrades
- Maintain Lagoons 2 and 3

The AOC requires that the Town line Lagoon 1 for continued use as influent flow equalization and sludge storage. The AOC also requires that the Town prepare a revised Lagoon Optimization Plan for continued use of the other two lagoons. Modifications to the disk filters were completed in early 2021 and lagoon system modifications will be completed and placed back in service by the end of December 2022. Discussion of lagoon operation can be found in Section 2.4.3. A detailed review of the regulatory requirements of the Town, including discussion of the 2017 AOC is included in Section 2.5.

1.3.12 *Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure (2019) by CDM Smith*

The final report of the *Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure* was completed by CDM Smith in June of 2019. In addition to documenting the 2019 existing conditions at the pump stations, this report provides a summary of the vulnerability and risk assessment of Marion's pump stations and neighborhoods with grinder pumps; evaluates design flood elevations; analyzes state and local code; assesses vulnerability and risk; and provides recommended mitigation measures. It also provides recommended improvements and climate adaptation strategies for each pump station. A detailed discussion of resiliency needs of Marion's Pump Stations are included in Section 2.3.3.

1.3.13 *Collection System Operation and Maintenance (O&M) Plan: Phase 2 (2019) by CDM Smith*

As part of its requirements within its 2017 National Pollutant Discharge Elimination System (NPDES) Permit for the WPCF, the Town with consultant CDM Smith, completed an assessment of the Capacity,

Management, Operation, and Maintenance (CMOM) of the collection system and corresponding Collection System Operation and Maintenance Plan. Contents of the plan include descriptions of the following:

- Collection system components and overall conditions
- Preventative Maintenance and Monitoring Program
    - Pumping Station Inspection and Maintenance
    - Manhole Inspection
    - Collection System Cleaning and Inspection
    - Root Control
    - Inflow and Infiltration Investigation
- Current Sewer Department staffing and staffing needs
- Sewer Department Funding
- Identification of Sanitary Sewer Overflows (SSOs) and System Backups
- Inflow & Infiltration Program (I&I) and Public Outreach Program
- Overflow Emergency Response Plan

Among the many findings of the O&M Plan, a need for additional staffing was highlighted. Much of the remainder of the document is used as a reference for operating procedures of the Sewer Department.

1.3.14 *Town-Wide Sewer Investigation & Improvement Program (2020) by Weston & Sampson*

The Town-Wide Sewer Investigation & Improvement Program (Annual Program), completed in October 2020 by Weston & Sampson, describes the components and development of Marion's Annual Program to reduce infiltration and inflow through the investigation and repair of the collection system. The report outlines the methodology and schedule for annual investigations and repair, which began in 2019 and are expected to continue through 2029. The Annual Program is an important tool for decreasing the volume of extraneous flow to the WPCF and is of great importance to the overall wastewater management of the Town. The Annual Program and its early results are discussed in greater detail throughout this report, particularly in Section 2.3.2.

2.0 EXISTING CONDITIONS ASSESSMENT

This section provides a detailed overview of current conditions in Marion. An evaluation of the existing conditions related to Marion's demographics and development, wastewater infrastructure, and regulatory environment was performed and is presented below.

2.1 Existing Conditions in the Study Area

The Town of Marion has approximately 14 square miles of land area. Land use in the Town primarily consists of residential uses, with large areas of conserved open space. Commercial and industrial land use is limited, only approximately 2% is commercial and only 1% is industrial. Open space and tax-exempt or limited taxable status properties represent more than half of the land use in Town, including Town facilities, churches, schools, land trusts, and protected agricultural, recreational and open space lands (Chapter 61, 61A, or 61B lands). Approximately 34% of the land area in Town has some form of a permanent conservation restriction placed on it.

2.1.1 *Demographics*

According to the US Census Bureau 2019 American Community Survey 5-Year Estimates (2019 ACS), the population in Marion in 2019 was 5,132[2]. The Town experienced a 4.4% increase in overall population between 2010 and 2019, compared to a 4% increase in population in Plymouth County for the same time period. The age distribution in Marion according to the 2019 US Census, is represented in Table 2-1 below:

Table 2-1: 2019 US Census – Age Distribution

Age Group	2019 Population (No. People)	2019 % of Population	% Change 2010 - 2019
Under 5	187	3.6%	17.5%
5-19	1,049	20.4%	10.9%
20-44	944	18.3%	-31.6%
45-64	1,564	30.5%	5.1%
65 and over	1,388	27.2%	29.5%

Source: 2019: ACS 5-Year Estimates Data Profiles

The number of housing units in Marion is 2,692, according to the federal census. According to census data, the number of "households" in Town showed a 2.2% increase from 2010 to 2019. In comparison, the number of households in Plymouth County increased by 6.5% between 2010 and 2019. The average number of persons per household increased slightly from 2.49 in Marion in 2010 to 2.50 in 2019.

According to the 2019 American Community Survey (ACS), the estimated median household income for Marion was $81,928 (inflation adjusted dollars). At that time, approximately 4% of household income in Marion was below the poverty level.

[2] Recent reports suggest that the 2020 population of Marion is 5,347.

2.1.2 *Land Use & Current Development*

The Town of Marion overall is sparsely developed, as shown by the aerial image in Figure 2-1 (attached). The Town has protected approximately half of the land area through various mechanisms, and as visible in Figure 2-1 (attached) maintains relatively large areas of undeveloped land. A significant portion of Marion is undeveloped and permanently protected by conservation restrictions. Table 2-2 below provides more information on land use in the Town.

Table 2-2: Land Use in Marion

Type	% Land Area
Residential	37
Commercial	2
Industrial	1
Agricultural/Recreational/Open Space (Chapter 61, 61A, 61B)	22
Tax-Exempt, including Conservation Land	31
No Data/Other	7

Source: Marion Master Plan 2017

The data presented in Table 2-2 above show that a significant portion of the Town is dedicated to residential use or restricts development (e.g., open space, recreation and conservation lands). With approximately half of the Town of land area protected by either conservation restriction or as Chapter 61, 61A, or 61B (protected agricultural, recreational and open space lands), future development potential is somewhat limited as there is not significant land area available.

2.1.2.1 Existing Residential Development

The Town of Marion has seen variations in the amount of single-family residential development over the last 20 years. The Town does not typically see large numbers of multi-family housing. On average,

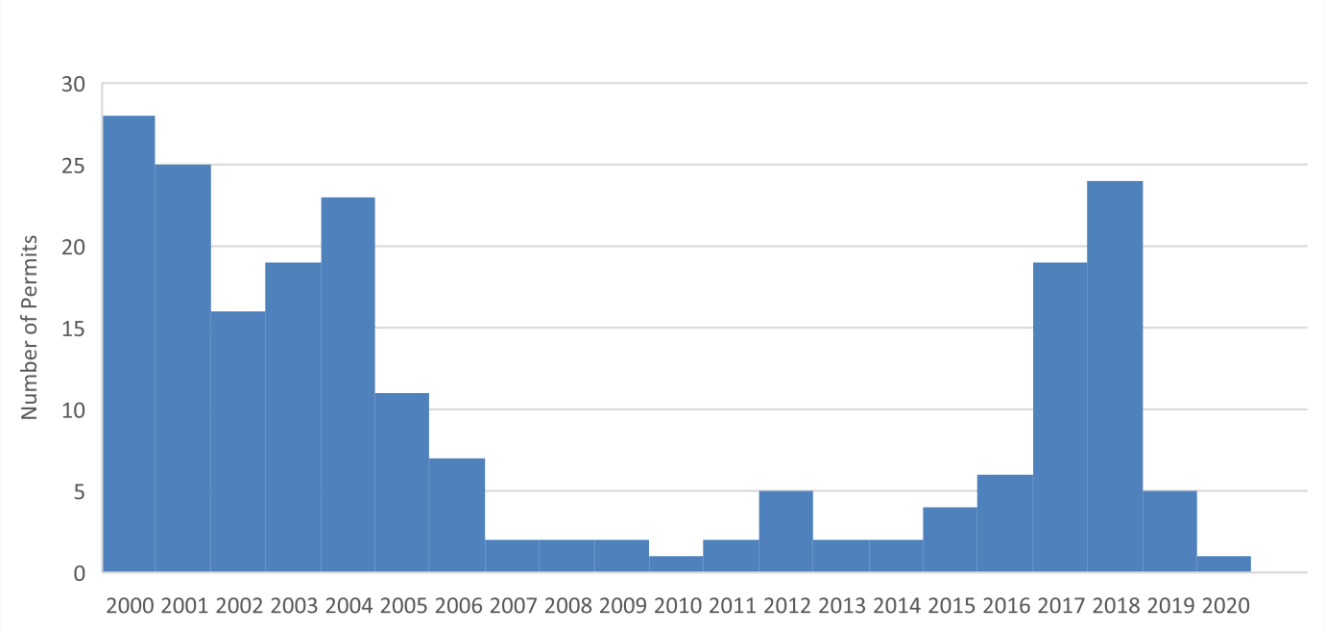

Figure 2-2: Single Family Building Permits Issued

Marion issues approximately 10 building permits a year for single-family home construction. Figure 2-2 provides additional information on building permits issued for single-family home construction.

As Figure 2-2 above indicates, from 2000 to 2004 the Town experienced relatively high numbers of single-family home construction. This trend dropped precipitously through 2014, and then began to climb again in 2015, ultimately reaching numbers similar to those in the early 2000s. This data is similar to a vast majority of communities that experienced a residential building slump from about 2005 until recent years when permit numbers began to climb again. Notably, over the past two years this number of new residential home construction building permits has again fallen.

2.1.2.2 Existing Commercial/Industrial Development

Marion has a limited amount of commercial and industrial development. Currently with approximately 3%[3] of land area zoned commercial and approximately 2%[3] of land zoned industrial, only around 5% of the entire Town is available for development for something other than what is allowed in residential districts. And as noted previously in the land use discussion, only approximately 3% of the Town's land is currently in use for commercial or industrial purposes. As identified in the 2017 Master Plan, Marion has two relatively small commercially developed areas, the Route 6 and Route 105 Gateway and the Point Road Commercial Area.

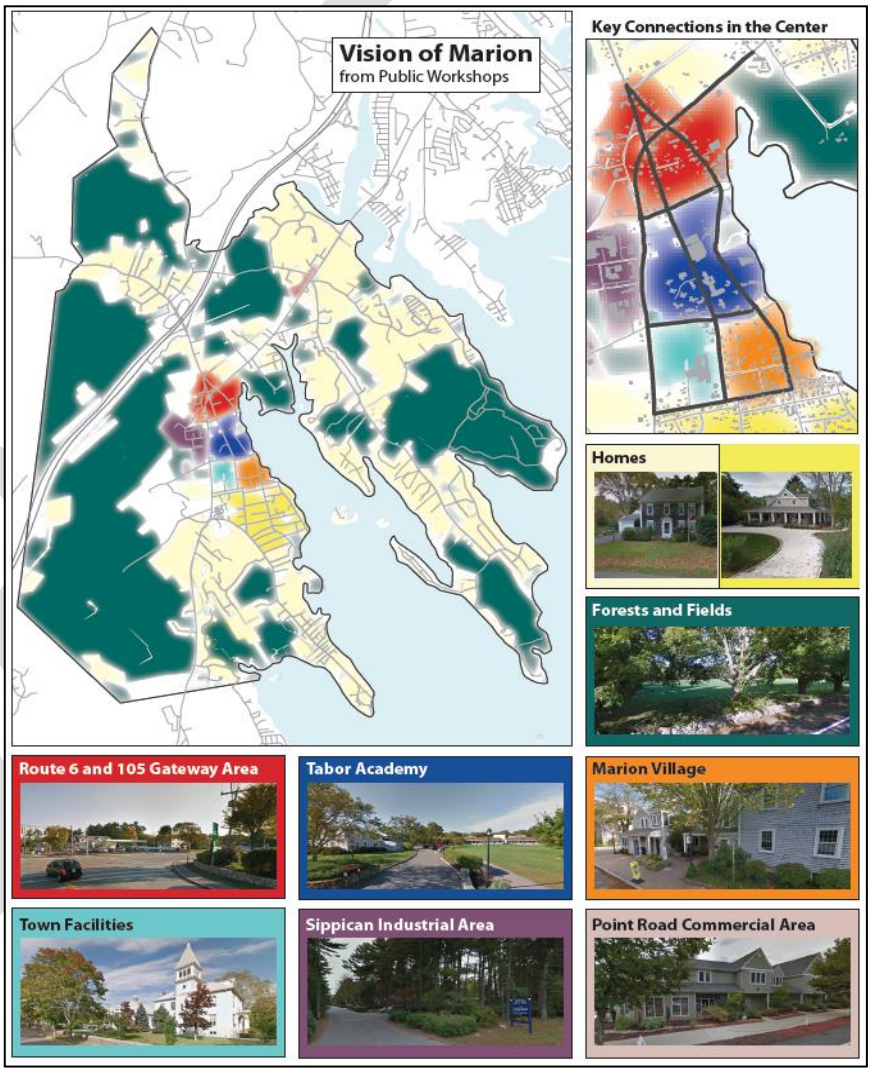

Figure 2-3: Commercial, Industrial, and Institutional Development from 2017 Master Plan

Marion is home to the Sippican Office Park, of which Lockheed Martin was the main tenant (until recently). According to the 2017 Master Plan, Sippican Office Park is mostly built out, but there is significant upland area remaining that abuts the park, which would allow for expansion of the existing facility. Figure 2-3, produced during the 2017 Master Planning

[3] These numbers are zoning and therefore vary from actual land use.

process, shows these areas of commercial and industrial development as well as the general location of Tabor Academy.

2.1.2.3 Tabor Academy

Marion is home to Tabor Academy, a boarding school for students in grades 9 through 12. The school is located on an 88-acre campus consisting of many parcels and buildings located through the Marion Village area. The Academy currently has over 500 students enrolled, and approximately 65% of those students are boarding students that live on the campus during the school year. In addition to the student dormitories, there are additional faculty houses located on the campus.

2.1.3 *Existing Zoning*

Marion's current zoning framework includes nine zoning districts, with five districts dedicated to residential development and four districts dedicated to commercial and light industrial development. Table 2-3 below identifies that approximate 94.7% of land area in Town is assigned to one of the five residential zoning districts and 3.2% of land area is assigned to one of three commercial districts, with 2.1% of land area assigned to the light industrial district. The Town employs eight overlay districts. These overlay districts address a variety of water related land uses as well as open space, solar, and wireless communications. Table 2-4 provides a list of overlay districts which are discussed in greater detail in subsequent sections.

Table 2-3: Zoning Districts

Zoning District	Description	Minimum Lot Size (ft^2)	% Land Area
RA	Residence A	21,780	1.4%
RB	Residence B	43,560	4.1%
RC	Residence C	87,120	21.1%
RD	Residence D	87,120	68.1%
RE	Residence E	40,000	0.03%
GB	General Business	15,000	2.4%
MB	Marine Business	15,000	0.6%
LB	Limited Business	15,000	0.2%
LI	Limited Industrial	15,000	2.1%

Table 2-4: Overlay Districts

District	Approximate Description
Flood Hazard District	100-year base flood elevations on the FEMA Flood Insurance Rate Maps (FIRM)
Aquifer Protection District	Zone I MassDEP Wellhead Protection Area
Water Supply Protection District	Zone II MassDEP Wellhead Protection Area
Surface Water District	All water areas within the municipal limits of the Town seaward of the low water mark as it is defined in Ch. 91 Regulations
Sippican River Overlay District	All contiguous portions of the Sippican River in Marion, its shores, and landward up to 200 feet from the normal high-water line
Open Space Development District	Land area >50 acres in Residential C District; given flexible development controls
Municipal Solar Overlay District	Town-owned real property (4 parcels) on which the installation of solar PV systems without the need for a special permit
Wireless Communications Facilities Overlay District	Siting of wireless communications facilities (5 parcels)

Figure 2-4 (attached) shows the Zoning Map of Marion, with the delineation of zoning districts as they were most recently mapped in 2014 and recodified in the Town's Zoning Bylaw in August of 2017.

Marion's zoning bylaw allows for a range of minimum lot sizes from approximately one-half acre in the RA zone to a 2-acre minimum lot size in the RC and RD zones. Most of the land area in Town (82.9%) that is zoned residential requires a minimum lot size of 2-acres. As identified in the 2017 Master Plan, this type of larger lot zoning scheme is helpful at reducing overall development density but does not allow for more compact and village style development, which was expressed as a desired development pattern by a majority of residents. Marion has adopted Conservation Subdivision regulations (Article X), which allow for more compact development patterns, while still retaining the density of the underlying zoning district. Smaller lot sizes can pose challenges to the siting of on-site septic systems for areas outside the sewer service areas.

2.1.4 *Existing Water Resource Protection Measures*

Coastal waters are a defining characteristic of the Town of Marion and are used extensively by residents for recreation and maritime professions. In addition to the local importance of the Town's surface water resources, groundwater resources are also important, as the Town relies on groundwater sources for water supply. Marion recognizes the importance of protecting its water resources and has done so with the programs and standards outlined in the subsequent sections.

2.1.4.1 Source Water Assessment Program (SWAP)

MassDEP completed a Source Water Assessment and Protection (SWAP) Program Report for the Town of Marion's public water system in 2003. The evaluation included several recommendations, including developing wellhead protection plans and regulations which have been implemented as identified in the section below.

2.1.4.2 Water Supply & Aquifer Protection Districts [Article VIII, § 230-8.2]

As discussed in Section 1.2.1.4, there is an aquifer in Marion just west of the Route 195 and Route 105 interchange from which Marion draws source water. Marion has established two drinking water related overlay zoning districts, the Water Supply and Aquifer Protection Districts, which serve to protect the

aquifer and its recharge area. Overall, the districts were formed to promote the public health, safety, and general welfare of the Town by:

- Protecting, preserving, and maintaining the existing and potential well sites and groundwater supply and watershed areas
- Preserving and maintaining the existing and potential groundwater supply and ground water recharge areas within the Town
- Preserving and protecting the streams, brooks, rills, marshes, swamps, bogs and other water bodies and watercourses in the Town
- Protecting the community from the detrimental use and development of land and water within the district
- Preserving and protecting the groundwater and water recharge areas within the Town
- Preventing blight and pollution of the environment

In general, the Town's Aquifer Protection District (APD) follows the Zone I MassDEP Wellhead Protection Area directly adjacent to the wellheads in place at this aquifer. The APD extends (as a radius) 1584 feet from the well head and includes an additional 25 acres south of the interchange. The Water Supply Protection District (WSPD) extends beyond the APD along the Zone II MassDEP Wellhead Protection Area. The Zone II is defined as the area of an aquifer that contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping with no recharge). The WSPD therefore extends from the Town's western boundary east to Route 6, as can be seen on the Zoning Map, Figure 2-4 (attached).

Within the Aquifer Protection District, only single-family residences connecting to sewer or located on a lot not less than one acre provided all excavation and grading maintains a depth of at least four feet of clean fill above the high-water table are allowed. Within the Water Supply Protection District, the outdoor storage, subsurface disposal, and commercial storage or treatment of solid waste, hazardous toxic materials, hazardous toxic wastewater, or otherwise noxious waste is prohibited. All other activities, excepting single-family residences, in the Water Supply Protection District may be issued a special permit by the Select Board, following recommendations from the Board of Health, Planning Board, and Conservation Commission.

2.1.4.3 Surface Water District [Article VIII, § 230-8.5]

Marion established a Surface Water District to provide municipal control of the use of coastal water areas which are not within any of the Town's land use zoning districts to protect and enhance the natural and man-made environmental qualities of the Town of Marion, encourage water-dependent uses where appropriate, and preclude uses which could evolve because other Town, state or federal laws and regulations do not provide sufficient protection of the public interest. The district is defined as all water areas within the municipal limits of the Town seaward of the low water mark as it is defined in Chapter 91 Regulations promulgated by MassDEP.

The Planning Board may allow a special permit for, among other uses, underwater sewer, water, and electrical lines and pipes. The Planning Board will seek recommendations from the Marine Resources Commission, Harbormaster, Select Board, Board of Health, and Conservation Commission prior to granting any special permit. The Planning Board must also determine that the proposed use is consistent with the provisions of the *Marion Master Plan*, the *Open Space Plan*, and any *Town of Marion Harbor Plan*.

2.1.4.4 Sippican River Protection Overlay District [Article VIII, § 230-8.7]

The purpose of the Sippican River Protection Overlay District is to preserve and protect the water quality, natural landscape, wildlife habitat, and adjacent land of the river and its shoreline. The area covered by this overlay district includes all contiguous portions of the Sippican River in the Town of Marion, its shores, and landward up to 200 feet from the normal high-water line (measured in horizontal feet). The upstream boundary of the district is the Rochester Town line; the downstream boundary is a line drawn from the tip of Rose Point to the westerly line of the Town beach lot on River Road.

The district provides additional river protection standards for all land uses, including residences, on riverfront lots. These protections, among others, include a buffer strip of 100 feet in depth, where the removal of trees and vegetation is limited, and building is prohibited. Additionally, on-site disposal systems must be located as far from the Sippican River as possible.

2.1.4.5 Wetland Protection Standards

The Conservation Commission has enacted four Wetland Protection Standards in order to be consistent in its deliberations and in the granting of permits, and in the application of the MassDEP regulations (310 CMR 10) pursuant to the Wetlands Protection Act (M.G.L. Chapter 131, Section 40). The Standards, generally, are as follows:

> Wetlands Protection Standard #1: No filling, cutting of vegetation, constructing in, or otherwise altering the first fifteen (15) feet of land adjacent to any Bordering Vegetated Wetland (BVW) line, or buffer zone, is not permitted. The construction of any building is not permitted within thirty (30) feet of the BVW line.
>
> Wetlands Protection Standard #2: MassDEP's field data form, identified as Appendix G in the March 1995 MassDEP handbook Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act, shall be used when delineating the boundaries of Bordering Vegetated Wetlands and provided with fillings to the Conservation Commission.
>
> Wetlands Protection Standard #3: When work is to be done on a building located in an AE or VE Flood Zone (both FEMA Special Flood Hazard Areas), the following items are to be included in all applications filed with the Conservation Commission: (1) A complete field card of the property from the Marion Assessors' office [OR an appraisal from a licensed appraiser indicating the current value of the building, not including the value of the land or other improvements on the land]. (2) A written estimate of the cost of the work to be done on the building. The estimate shall be prepared by the person or company that will be performing the work. (3) A copy of the plans and other documents that will be submitted to the Marion Building Department with the building permit application.
>
> Wetlands Protection Standard #4: The Conservation Commission may impose reasonable fees for the employment of outside consultants.

2.1.4.6 Septic System Denitrification Regulation

The Marion Board of Health approved a *Septic System Denitrification Regulation* in July 2020 for the purpose of limiting nitrogen discharges from new and expanded flows from septic systems. For all new on-site septic systems and those which have been determined by inspection to be a nonconforming failed system at the time of transfer of title, denitrification systems are required to be installed, operated,

and maintained to achieve a system performance target of 19 mg/l or less Total Nitrogen (TN) in the system's effluent. Alternative systems may be considered for variances by the Board of Health if it can be shown that the alternative system will result in equal or greater nitrogen reduction or that full compliance with the standards in the regulation is infeasible due to site or technical constraints.

Prior to issuing an operating permit, the Board of Health must approve an operation and maintenance plan including the provisions specified in the *Septic System Denitrification Regulation*. The Board of Health may also require additional maintenance and monitoring. Should public sewer become available after the installation of a denitrification system, a property or facility is required to connect in a timeframe that is twenty years minus the age of the existing denitrification system.

2.1.5 *Flood Hazard Protection Measures*

Marion has a zoning overlay district, the Flood Hazard District, which was established to prevent unnecessary loss of life or injury to waterfront resident, to reduce the need for rescue efforts, and to prevent the destruction of property by ocean water, waves, and debris landward by high-wind storms. The Flood Hazard District includes all special flood hazard areas within the Town of Marion designated as Zone A, AE, AO, or VE on the *Plymouth County Flood Insurance Rate Map* (FIRM) issued by the Federal Emergency Management Agency (FEMA) for the administration of the National Flood Insurance Program. The exact boundaries of the District may be defined by the one-hundred-year base flood elevations shown on the FIRM and further defined by the *Plymouth County Flood Insurance Study* (FIS) report dated July 17, 2012. The boundaries of the Flood Hazard Districts described as the low water mark of adjoining tidal waters as defined in Chapter 91, The Massachusetts Public Waterfront Act, Regulations promulgated by MassDEP. Attached Figure 2-5 (attached) shows additional details of the FEMA Flood Hazard Areas as produced by CDM Smith for their 2019 Report, *Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure*. This report is discussed in greater detail in Section 1.3.

The Zoning Board of Appeals may permit or authorize use in the district by special permit subject to the special provisions of Marion's Zoning Bylaw (Article VIII, § 230-8.1) which include required setbacks and adequate building area requirements.

Though not included in the Flood Hazard District, the Town also uses National Hurricane Center Sea, Lake and Overland Surges from hurricanes (SLOSH) hurricane surge inundation zones developed by the National Oceanic and Atmospheric Administration (NOAA), most recently updated in 2013, to inform decisions about the siting and flood mitigation measures for Town infrastructure, including wastewater infrastructure. The SLOSH map for Marion, as included by CDM Smith in their 2019 Report, *Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure*, can be found in attached Figure 2-6(attached).

2.2 Existing On-site Systems

In 2020, as part of this CWMP effort, a preliminary review of Board of Health records was performed. This review confirmed the number and location of numerous on-site systems, variances to Title 5 restrictions granted, and upgrades made to existing systems, particularly those since 2000. However, these records are not presumed to be exhaustive nor capture every on-site system currently in use in Marion. The BOH records, combined with sewer use records, mapping, and professional engineering judgement, have led to the understanding that approximately 940 developed parcels (37% of developed parcels) in Marion use on-site systems (individual septic systems) for wastewater disposal and are not

connected to the centralized wastewater collection and treatment system. Currently, none of the private wastewater treatment systems in operation require a groundwater discharge permit. Most of the on-site systems in Marion are typical septic systems with a separate septic tank and subsurface leaching system. The leaching systems are trenches and fields, with many of the post 1980 systems constructed with concrete galleys, or flow diffusers. Newer systems have also utilized plastic infiltrator chambers. Some of the oldest systems prior to the 1950s are simple cesspools or have been modified to add overflow trenches to regain leaching potential. In these cases, the existing cesspools, even if antiquated, provide some solids settling and decomposition although may not be sized appropriately. Many systems constructed in the 1960s through 1980s used a 1,000-gallon septic tank and a leaching filed to infiltration leachate. As of 2020, the average age of on-site systems in Marion is estimated to be greater than 55 years old, based on the records available or review including Assessor's information. Also based on the records available, fewer than 20 on-site systems have been repaired or upgraded since 2000.

Revisions to Title 5 in 1995 required that sufficient land area be provided for each residential home site in nitrogen sensitive areas to ensure that the nitrogen loading was not excessive. The regulations require that a minimum of 10,000 square feet of land be provided for each bedroom within designated aquifer protection area. This requires new house lots with 4-bedroom designs to have a minimum lot size of 40,000 square feet or almost an acre. While this restriction has limited the expandability of some homes, those undersized properties in existence before 1995 are exempt from the limitations but cannot expand beyond the current number of bedrooms.

As described in Section 2.1.4.6, the Town's *Septic System Denitrification Regulation* came into effect in July 2020 for the purpose of limiting nitrogen discharges from new and expanded flows from septic systems. Denitrification systems are required for all new on-site septic systems, at the time of transfer (if non-conforming) and for failed systems. Alternative systems may only be considered for variances by the Board of Health if it can be shown that the alternative system will result in equal or greater nitrogen reduction or that full compliance with the standards in the regulation is infeasible due to site or technical constraints.

2.3 Existing Sewer System Description and Condition

The municipal sewer system in the Town of Marion is comprised of approximately 18 miles of gravity sewer ranging in size from 4- to 18-inches in diameter, 8 Town-owned pump stations, 4.5 miles of force main, and 550 sewer manholes, as well as 8.5 miles of low pressure sewers with approximately 500 individual on-lot grinder pump units. There are also several private wastewater collection systems that discharge to the municipal system, which brings the total number of on-lot grinder pump units in Town to approximately 700. The Town-wide sewer system is shown in Figure 1-12 (attached). Wastewater is treated at the WPCF, which is located at 50 Benson Brook Road, and is permitted to discharge 588,000 gallons per day (GPD) of treated effluent on an average daily flow basis following the tertiary process.

2.3.1 *Sewersheds*

The existing wastewater collection system was sub-divided into twenty-four (24) subareas, or Sewersheds, and that designation is used for overall system reference and Town Infiltration and Inflow analysis projects. Figure 2-7 (attached) details the extent of each Sewershed. Each of the Sewersheds is identified in one the following categories, as defined by a downstream pump station or outfall tributary.

- C – Creek Road Pump Station Tributary, comprised of seven (7) subareas

- F – Front Street Pump Station Tributary, comprised of eight (8) subareas
- S – Silvershell Pump Station Tributary, comprised of two (2) subareas
- LP – Low Pressure Sewer Tributary, comprised of six (6) subareas
- OF – WPCF Outfall Sewer, comprised of (1) subarea

System descriptions have been developed for each Sewershed area and are presented in the following sections. Conditions of the existing collection system are described in greater detail in Section 2.3.2 as part of the program to identify and remove infiltration and inflow.

2.3.1.1 C – Creek Road Pump Station Tributary

There are seven Sewersheds, all located in East Marion, tributary to the Creek Road Pump Station identified in Figure 2-8 (attached). Details for each these Sewersheds can be found in Table 2-5 below. There are five pump stations located within the Creek Road Pump Station Tributary Area that ultimately discharge to the Creek Road Pump Station: Oakdale Avenue PS, Littleneck PS, Parkway Lane PS, Point Road PS, and Stoney Run PS.

Table 2-5: Sewersheds Tributary to Creek Road Pump Station

Sewershed	Approx. Location	Tributary Pump Station (PS)	Composition
C-1	Point Road and Bullivant Farm Road	Point Road PS & Creek Road PS	890' of 4-inch CI Force Main 3,600' of 8-inch Gravity Sewer 3,900' of 12-inch Gravity Sewer 380' of 4-inch LP Sewer
C-2	Delano Road and Stoney Run Lane	Stoney Run PS & Creek Road PS (Included in C-2)	1,300' of 4-inch Force Main 6,800' of 8-inch Gravity Sewer
C-3	Point Road and Creek Road	Creek Road PS	840' of 8-inch Gravity Sewer 3,160' of 10-inch Gravity Sewer
C-4	Point Road, Creek Road, and Joanne Drive	Creek Road PS	6,850' of 8-inch Gravity Sewer
C-5	Wareham Road, Oakdale Avenue, and Hermitage Road	Oakdale Avenue PS & Little Neck PS	Oakdale Avenue PS: 2,700' of 8-inch Gravity Sewer (to) 1,720' of 4-inch DI Force Main (from) Littleneck PS: 1,150' of 8-inch Gravity Sewer (to) 620' of 4-inch Force Main (from)
C-6	Wareham Road, Point Road, and Parkway Lane	Parkway Lane PS & Wareham Road	Parkway Lane PS: 360' of 6-inch Gravity Sewer (to) 620' of 4-inch PVC Force Main (from) Creek Road PS: 4,400' of 8-inch Gravity Sewer (to) 2,840' of 10-inch Gravity Sewer (to)
C-7	Creek Road and Wareham Road	Creek Road PS	4,300' of 8-inch Gravity Sewer 460' of 10-inch Gravity Sewer

LP – Low Pressure

2.3.1.2 F – Front Street Pump Station Tributary

There are eight Sewersheds, all located in the Marion Village Area, tributary to the Front Street Pump Station identified in Figure 2-9 (attached). Details for each these Sewersheds can be found in Table 2-6 below. Detailed mapping for each Sewershed can be found in Appendix A.

Table 2-6: Sewersheds Tributary to Front Street Pump Station

Sewershed	Approx. Location	Tributary Pump Station (PS)	Composition
F-1	Front Street and South Street	Front Street PS	1,402' of 4-inch Force Main 3,230' of 8-inch Gravity Sewer
F-2	Front Street and South Street	Front Street PS	840' of 6 Inch-Gravity Sewer 600' of 8 Inch-Gravity Sewer 1,290' of 10-inch Gravity Sewer 3,160' of 12-inch Gravity Sewer
F-3	Pleasant Street and Main Street	Front Street PS	3,800' of Unknown Size Sewer 65' of 4-inch Gravity Sewer 360' of 6-inch Gravity Sewer 5,500' of 8-inch Gravity Sewer
F-4	Cottage Street and Front Street	Front Street PS	90' of 4-inch Gravity Sewer 1,030' of 6-inch Gravity Sewer 660' of 8-inch Gravity Sewer
F-5	Front Street	Front Street PS	1,239' of 6-inch Gravity Sewer 1,715' of 8-inch Gravity Sewer 2,095' of 10-inch Gravity Sewer 325' of 12-inch Gravity Sewer 1,050' of 16-inch Gravity Sewer 2,640' of 18 -inch Gravity Sewer 4,300' of 14-inch CI Force Main
F-6	Mill Street, Spring Street and Front Street	Front Street PS	2,040' of 6 & 8-inch Gravity Sewer 980' of 8-inch Gravity Sewer 2,330' of LP Small Diameter Force Main
F-7	Spring Street, Ryder Lane, and Front Street	Front Street PS	390' of 6-inch Gravity Sewer 740' of 8-inch Gravity Sewer 2,050' of 10-inch Gravity Sewer
F-8	Old Mill Road, Wells Road, and Front Street	Front Street PS	650' of 6-inch Gravity Sewer 2,360' of 8-inch Gravity Sewer

LP – Low Pressure

2.3.1.3 S – Silvershell Pump Station Tributary

There are two Sewersheds, both located in the Marion Village Area, tributary to the Silvershell Pump Station identified in Figure 2-10 (attached). Details for each these Sewersheds can be found in Table 2-7 below. Detailed mapping for each Sewershed can be found in Appendix A.

Table 2-7: Sewersheds Tributary to Silvershell Pump Station

Sewershed	Approx. Location	Tributary Pump Station (PS)	Composition
S-1	Cove Street, Zora Road, and Front Street	Silvershell PS	3,700' of 8-inch Gravity Sewer 1,340' of 16-inch Gravity Sewer
S-2	Water Street, Allen Street, and Lewis Street	Silvershell PS	1,140' of 6-inch Gravity 7,820' of 8-inch Gravity Sewer 630' of 12-inch Gravity Sewer 43' of 16-inch Gravity Sewer 1,840' of 8-inch CI Force Main

2.3.1.4 LP – Low Pressure Sewer Tributary

There are six Sewersheds located in East Marion and the Marion Village Area which are low pressure sewer identified in Figure 2-11 (attached). Details for each these Sewersheds can be found in Table 2-8 below. Detailed mapping for each Sewershed can be found in Appendix A.

Table 2-8: Low Pressure System Sewersheds

Sewershed	Approx. Location	Tributary Pump Station (PS)	Composition
LP-1	Front Street North of I-195 Spring Street the Berry Patch Area	Front Street PS (via Front Street Gravity Sewer)	10,860' of 1.5 to 4-inch LP Sewer 645' of Force Main
LP-2	Delano Road and the Dexter Beach Area	Creek Road PS (via Delano Road Gravity Sewer)	12,100' of 1.5 to 4-inch LP Sewer (via Delano Road Gravity Sewer)
LP-3	Point Road and Joanne Drive	Creek Road PS (via Point Road Gravity Sewer)	4,130' of 2-inch LP Sewer
LP-4	Point Road and Joanne Drive	Creek Road PS (via Point Road Gravity Sewer)	9,975' of 1.5 to 2-inch LP Sewer
LP-5	Olde Knoll Road and Converse Road	Silvershell PS (via Zora Road Gravity Sewer)	13,300' of 1.5 to 4-inch LP Sewer
LP-6	Converse Road	Silvershell PS (via Cove Road Gravity Sewer)	13,500' of 1.5 to 4 Inch LP Sewer

LP – Low Pressure

2.3.1.5 OF – WPCF Outfall Sewer

There is one Sewershed which includes the WPCF outfall identified in Figure 2-12 (attached). Sewershed OF-1 is in the Marion Village Area near Mill Street and Abel's Way. It is comprised of 4,500 feet of reinforced concrete pipe, parts of which were upgraded in the early 2000s. The outfall discharges to the Unnamed Tributary, often referred to as Effluent Brook or Gifford's Brook, which is tributary to Aucoot Cove. This is further discussed in the WPCF description, included later in this section of the CWMP report.

2.3.2 *Infiltration & Inflow (I&I)*

Infiltration and inflow (I&I) is extraneous groundwater and stormwater that enters into the sewer directly or indirectly which does not need to be treated at the Town's WPCF. Infiltration of groundwater seeps into sewer pipes through cracks, holes, joint failures, and faulty connections. Inflow of stormwater enters sewers through direction connections like roof drain downspouts, foundation drains, and storm drain cross-connections, and through holes in manhole covers. This excess water contributes to the increasing capacity demands on Marion's collection system and elevated wet weather flows at the WPCF. It is estimated that I&I contributes up to 40% of the Town of Marion's sewer flow. I&I control and mitigation helps to protect the environment and reduces the volume of wastewater to be treated, and therefore also associated treatment costs.

A major reason for the Town's current I&I issue is the age of the gravity collection system. A large portion of the gravity sewer system, according to our records, was installed prior to 1980 which is why a significant portion is vitrified clay (VC) and asbestos clay (AC) pipe. The VC gravity sewers in the Village Area of Town are most likely a significant reason for the I&I problems. VC pipe is susceptible to shifting over time causing open joints and cracks that cause infiltration to enter the sewer and also potential operation and maintenance concerns. AC pipe is also prevalent in Town, and has been identified tributary to the Silvershell and Creek Road Pump Stations, in particular, during recent inspections. AC utilized as sewer pipe has shown to be resistant to I&I when in fair condition. However, over time AC is prone to punctures and spalling, and both types of defects have been identified in recent inspections of the Town's gravity AC sewers.

Over the past two decades, Marion has been engaged in a program to evaluate its collection system, identify significant sources of infiltration and inflow (and other pipe defects), and perform corrective repairs to the system. Starting in the early 2000's this work included a multi-phased Sewer System Evaluation Survey (SSES), during which the Town evaluated the entire system. The last phase of that SSES process was reported on in 2018, but work on the system has continued. In more recent years, the Town of Marion has engaged in a Capacity Management Operation and Maintenance (CMOM) program – a systematic program to evaluate, maintain and protect the wastewater infrastructure in Town. The Town's commitment to CMOM has included re-engaging the focus on infiltration/inflow control into a new multi-year program.

The Town of Marion has not performed a dedicated sewer flow metering program in recent years (the last system-wide metering was done in the earlier phases of the SSES program). Typically, a program like this would quantify any I&I contributions for each Sewershed to identify problem areas. However, these flow metering programs are dependent on unpredictable weather conditions and groundwater presence, and the Town has a limited budget to dedicate to I&I identification and removal each year. Yet, by reviewing recent annual flows at the WPCF versus local rainfall, as recorded at a nearby Rochester, Massachusetts weather station and the rainfall gauge at the WPCF (summarized in Table 2-

9 and shown graphically in the figures that follow), it is clear that wet weather has a significant impact on the collection system and WPCF flows. In addition, Town staff has observed that the WPCF is particularly affected by high flows when there are multiple significant storm events within a few days of one another. These observations potentially conclude that as the ground gets saturated is when I&I is potentially the biggest problem. This could mean that indirect inflow sources, like sump pumps, and infiltration could be a large percentage of the Town's total I&I.

It should be noted, that while there is a correlation between WPCF flow and annual rainfall, it is not exact; the presented metrics do not account for snowfall or any flow variations due to the use of the lagoons for equalization.

Table 2-9: Daily Flows and Precipitation at the WPCF

Calendar Year	Annual Rainfall (in.) Rochester, MA	Annual Rainfall (in.) Marion WPCF	Average Daily Flow (MGD) Marion WPCF
2017	52.72	46.48	0.507
2018	71.44	50.72	0.569
2019	60.13	42.36	0.591
2020	40.02	35.01	0.455

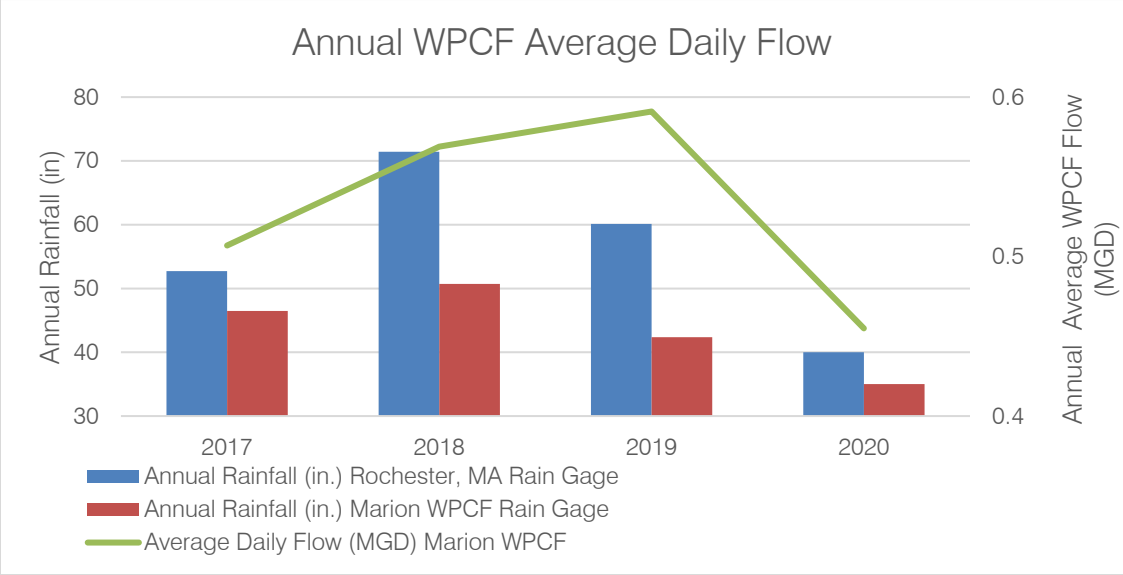

Figure 2-13 Annual Rainfall vs. Flow at Marion WPCF

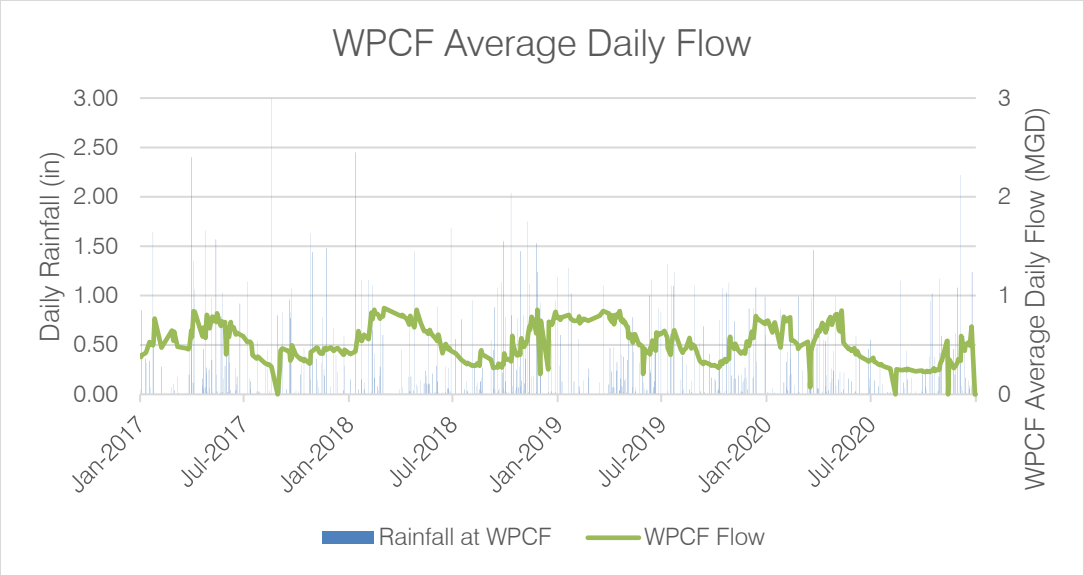

Figure 2-14: Daily Rainfall vs. Flow at Marion WPCF

Therefore, in June 2019, the Town embarked on a dedicated Town-Wide Sewer Investigation & Improvement Program (Annual Program). The Annual Program was established to investigate and repair the collection system on a regular basis, thereby identifying and repairing I&I sources to reduce flow within the system. The long-term program will allow the Town to create capacity within the existing system through I&I reduction while the collection system management component of the program will endeavor to decrease the number of blockages, back-ups and potential sewer system overflows (SSOs), and customer claims.

The Annual Program is currently designed to investigate and repair the entire sewer system over a ten-year period, with an annual budget of $190,000 per year. This will allow the Town to investigate approximately 10,000 LF of sewer per year. Each yearly phase of the program includes:

- Television inspection of sewer main lines
- Topside manhole inspections
- Sewer mapping and database updates
- Construction of recommended repairs (cured-in-place pipe installation and manhole cementitious lining)

As of July, 2021, the status of the annual program is as follows:

- Construction of the Year 2 recommended repairs and improvements was completed in May 2021. Warranty inspection of the repairs will be scheduled within one year of the construction's substantial completion.

- Investigation of the Year 3 project area was performed in August 2021. The data was reviewed and a report was issued to the Town in December 2021. This investigation included sewers in Sewersheds F-1, F-2, F-3, F-5 and S-2.

Table 2-10: Annual Program Status

Program Year	Program Dates	Problem Area Sewersheds	Work Completed	Estimated I&I Removed
Year 1	June – Nov. 2019	C-1, C-6, F-1, F-3, F-4, F-7, S-1, S-2	Inspected and/or Repaired 7,000 LF of 8-inch Sewer	4,680 GPD
Year 2	May 2020 – May 2021	F-1, F-2, F-3, F-4, F-5, F-8	Inspected and/or Repaired 10,500 LF of 6 to 18-inch Sewer	8,200 GPD
Year 3	Apr. 2021 - Present	F-1, F-2, F-3, F-5 and S-2	Inspected 9,700 LF of 6 to 10-inch Sewer	15,000 GPD (Observed)
			Total Removed	27,880 GPD

The timing and location of work for the Annual Program was prioritized based on known problem areas and the known physical pipe characteristics and environment. The priority evaluation ranked the Town's Sewersheds on the following criteria:

- Problem Areas – Information on the severity and frequency of chronic problem areas reported by the Town was used to prioritize sewer basins. Sewer basins with significant specific problems were given priority and were partially inspected as part of Year 1 and Year 2 of the program. It is also considered good housekeeping to investigate the remaining sewer segments in these Sewersheds.

- Sewers within the Village Area – The Village Area sewers are the oldest gravity sewers, with sewer construction in this area beginning over 100 years ago and the highest percentage of vitrified clay (VC) sewers. VC sewers are more susceptible to I&I and structural issues. This is due to the fragile nature of VC along with the higher quantity of pipe joints (typically every three feet in older sections).

- Areas Within the 100-Year Flood Zone – Sewer basins with low-lying areas or high groundwater. The 100-Year Flood Zones are shown in the Town's sewer map in Figure 2-7 (attached). More than 60% of the Town's sewer system lies within the 100-year flood zone.

Sewersheds that did not fall under any of the categories above or were recently repaired were considered lower priority. Also, six sewer basins (LP-1 through LP-6) only include low pressure sewers and one sewer basin (OF-1) is the WPCF's outfall and were not included in this program. Therefore, only 17 of the 24 Sewersheds were included in the priority evaluation. Table 2-11 outlines the Annual Program sewer investigation and improvement schedule.

Table 2-11: Annual Program – Sewer Investigation & Improvement Schedule

Sewershed	Program Year	Estimated Sewer Length (LF)	Investigated To Date (LF)	Remaining to be Investigated (LF)
C-1	1, 2, 8	7,509	793	6,716
C-2	9	6,864	0	6,864
C-3	10	3,775	0	3,775
C-4	10	7,119	0	7,119
C-5	8	3,846	0	3,846
C-6	1, 7	7,599	1,033	6,566
C-7	9	4,850	0	4,850
F-1	1, 2, 3	3,867	3,867	0
F-2	2, 3, 4	5,922	4,731	1,191
F-3	1, 2, 3	8,411	8,411	0
F-4	1, 2	1,444	1,444	0
F-5	2, 3, 6	8,803	1,293	7,510
F-6	7	3,028	0	3,028
F-7	1, 5	3,138	422	2,716
F-8	2, 4	3,397	873	2,524
S-1	1, 4	5,034	886	4,148
S-2	1, 3, 5	8,958	3,463	5,495
	Overall	93,564	27,216	66,348

While only approximately 29% of the gravity sewer system has been inspected to date as part of the Annual Program, a snapshot of the general condition of the system has come into view. Of the 115 sewer segments that have been visually inspected, a variety of defects as well as obstructions were observed in approximately 48% of the sewer segments. This has reinforced that this Annual Program will be an important operation and maintenance tool in addition the critical role it is playing in reducing flow at the WPCF.

Because the Town's primary goal in establishing this Annual Program is to reduce wastewater flow, investigation phases focus mostly on infiltration identification and removal. Infiltration is generally expected to be present in wastewater flow throughout the year, and especially in areas with consistently high groundwater. Removal of infiltration will provide a consistent increase in available capacity.

Infiltration along Front Street Sewer

Removal of inflow sources, on the other hand, may reduce sewer surcharging and overflows during wet weather events, rather than the day-to-day average flow. Therefore, inflow investigations are to be revisited at the end of the program. The apparent correlation between wet weather events and increased flow at the WPCF, shown in Table 2-9 and Figure 2-14, indicate that some of the rainfall-induced infiltration may be able to be identified through infiltration investigations and removed from the system thereby reducing wet-weather flow by some margin. In addition, inflow that may enter the system through sewer manholes will be identified as part of the manhole inspections that are scheduled to be performed each spring. Similarly, mitigating those potential sources will also reduce wet-weather impacts at the pump stations and the WPCF.

The full Year 2 Sewer Investigation Report is included in Appendix B.

2.3.3 *Existing Sewer Pump Stations (PS)*

The Marion Department of Public Works operates and maintains eight Town-owned pump stations that convey the centralized wastewater from the sewered areas of the Town to the WPCF. These pump stations vary in design and age, with the oldest station built around 1957, though certain stations have received upgrades since their initial construction. The stations' locations and general pump capacities are summarized in Table 2-12, and general stations' locations are depicted on Figure 1-12 (attached). Three pump stations exist within private sewer systems: the Marion Village PS, and two small systems that serve single buildings (Sippican PS at the Lockheed property, and Racquet Club PS). These pump stations are not owned or maintained by the Town.

Table 2-12: Town-Owned Wastewater Pump Stations

Pump Station Name	Approximate Location	Installation Date	# Pumps & Capacity [1]
Front Street (Main) Pump Station	On Front Street, adjacent to the Tabor Academy campus	1970	4 pumps 2,100 gpm [2]
Silvershell Pump Station	Corner of the intersection of Front and Lewis Streets	1957	2 pumps 300 gpm
Creek Road Pump Station	Creek Road near intersection of Wareham Rd (Route 6)	1972	2 pumps 520 gpm
Oakdale Pump Station	Intersection of Oakdale Avenue and Oakdale Avenue Extension	1993	2 pumps 240 gpm
Littleneck Pump Station	Within Littleneck Village off of Wareham Road	2011	2 pumps 240 gpm
Parkway Lane Pump Station	Between 23 Parkway Lane and 19 Parkway Lane	1986	2 pumps 135 gpm
Point Road Pump Station	Intersection of Point Road and Bullivant Farm Road	1966	2 pumps 120 gpm
Stoney Run Pump Station	Near Edgewater Lane and Stoney Run Lane intersection	1996	2 pumps 295 gpm

[1] This table provides nominal capacity based on existing information. Refer to detailed descriptions for discussion of station capacity.
[2] Reporting on pump capacity at Front St PS varies. The 2,100 gpm is the nameplate capacity for the large pumps. Refer to the Front St PS writeup for further discussion.

The Front Street (Main) Pump Station is a large custom structure with a dry pit configuration, and the Creek Road Pump Station is a packaged dry pit station. The remaining six pump stations are configured with submersible pumps, though a number of these have a small building on site. Figure 2-15 schematically depicts the tributary contributions of the pump stations within the Marion system.

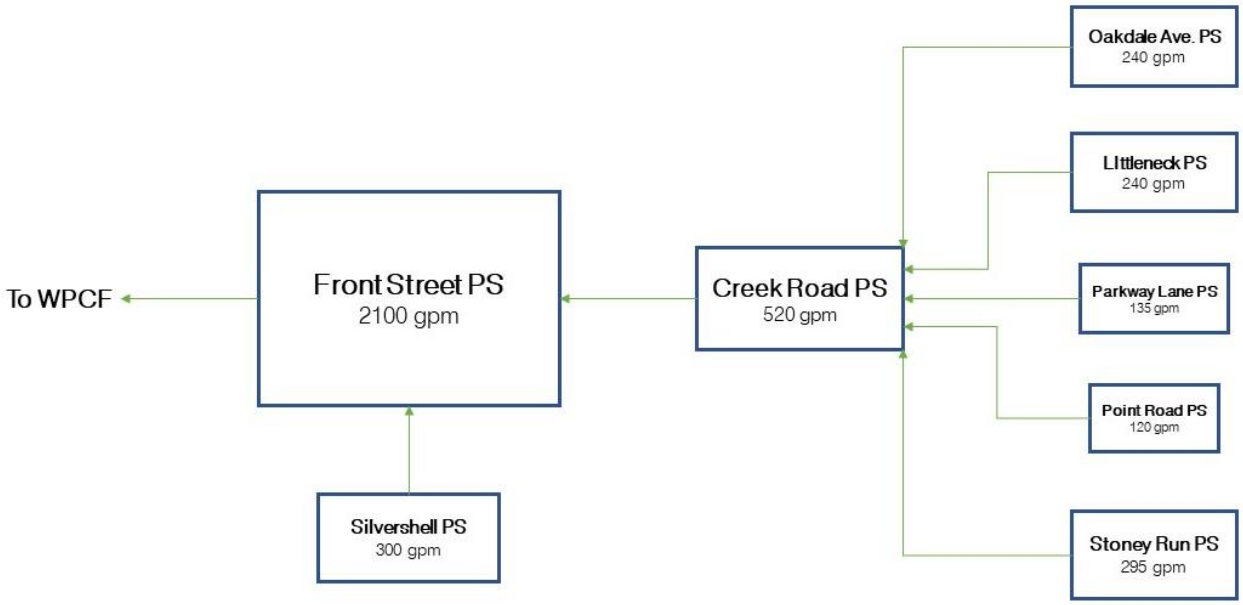

Figure 2-15: Pump Station Flow Schematic

The existing conditions at Marion's wastewater pump stations show several issues common to the system. As is observed in many communities, the sewer stations and equipment have deteriorated due to age, and some of the technology incorporated into the stations is outdated, so modernization improvements will be notable needs. More notably for Marion, the low-lying nature of the stations in the coastal setting present challenges related to resiliency. Most of the stations are located below the 100-year flood elevation. Additional specific discussions of each station are included as follows (the order of the presented discussions generally follows the tributary relationships presented in Figure 2-15 but is not otherwise intended to convey any priority), and a summary discussion of coastal resiliency issues is included at the end of this section.

2.3.3.1 Front Street Pump Station

The Front Street Pump Station was visited for an assessment of its existing conditions on April 17, 2020 by the Town of Marion operators and Weston & Sampson. The following description of the station is based on observations from this assessment, along with follow up discussions.

The Front Street (Main) Pump Station (PS) is located approximately 200 feet west of Front St, adjacent to the Tabor Academy campus (and approximately 550 feet east of the Marion Fire Department's Spring Street fire station). The current Front Street PS was constructed c. 1970 as part of the Town's Contract 2 Sewer Improvements. The area around the station is well maintained, in keeping with the campus location, and the station is generally neat in appearance. Despite being located more than 500 feet from the waterfront, the entire site is within the coastal floodplain, and consistent with the local service area, lies below the 100-year flood elevation. In general, existing grade around the pump station lies between

elev. 8 feet and 9 feet. The PS is a custom station, constructed of cast-in-place concrete, with a masonry superstructure.

The station entrances are elevated approximately 8 feet above the parking area and surrounding grade, to protect against flood damage. The raised entry platform is accessed by a concrete stairway, equipped with a locked gate for security. A double entry door leads to the 'dry side' of the PS with control equipment, generator set and pump area, while a single door leads to the wetwell access area. The condition of the deck and exterior brickwork is generally good, and the access doors are functional. The flat concrete roof appears to be watertight, (based on no known leakage), but the roof was not accessed to confirm the condition. The pump station structure has a footprint measuring approximately 27 feet by 28.5 feet, excluding the entry deck and stairs.

Front Street Pump Station

The wetwell area is accessed via a small upper level (approximately 6 feet by 10 feet). Ventilation equipment is also located in this area. The spiral stair leads down to an operating level (measuring approximately 10 feet wide by 25 feet long) with a floor elevation of approximately 0.0 feet. This level has a system of influent channels covered with grating and has a sluice gate and two slide gates that can be used to isolate the two separate wetwells. One channel includes a Muffin Monster sewage grinder for macerating incoming solids, while the parallel channel includes a manual bar rack. The sewage grinder and wetwell/channel slide gates were replaced in recent years, but the sluice gate at the incoming line appears original. That gate is in need of repair/replacement. A fixed gas detection system has sensor heads located on this level. Heating and lighting in the wetwell access area appears functional. An odor control ventilation system draws air from the area and processes it through carbon system (located at grade, outside the PS). The wetwell below the operating level has two chambers, each approximately 10 feet by 10.5 feet in area.

Wetwell Influent Channel Area

The following wetwell observations were made during the site visit:

- Wetwell access via the spiral stair is difficult when moving tools or equipment and provides limited access for wetwell cleaning.

- Based on discussion with operators, the influent sluice gate in the wetwell area is not functional and needs replacement.
- Air flow in the operating area is lower than in the dry side, as the air here is exhausted through the odor control system. However, no significant odors or hydrogen sulfide were observed during our visit.
- Solely on observation from the operating level, the exposed concrete walls of the wetwell appeared to be in good condition.
- The limited discharge piping and valves running through the wetwell area show significant corrosion.
- The actual wetwell areas (below the operating deck) were not accessed for observation.

The 'dry side' of the PS has functional equipment on the upper level (approximately elevation 18.0 feet), which includes an open area (an L-shaped level roughly 20 feet by 25 feet) housing electrical and controls equipment, mechanical heating and ventilating equipment, and the standby generator set. Two separate rooms are accessed from this room, including a service room/bathroom facility (roughly 6 feet by 10 feet), and a control room (roughly 7 feet by 10 feet).

Dry-Side Pump Pit

An open stairway leads down to the lower pump level. Located just inside the doorway, and adjacent to the stairs is a single floor opening with a removable plate to allow the removal/replacement of equipment from the lower level. The main area is very crowded with equipment, including areas with limited headroom clearance. Much of the remaining area around equipment is used to store parts and maintenance supplies for the PS.

Equipment on this level includes the four variable frequency drives (VFDs) that control the wastewater pumps – the drives are Cutler-Hammer drives (two CP9000 models for the larger pumps, and two SVX9000 models for the smaller pumps). Standby power is provided by a three-phase generator set – a Kohler 110 kW diesel fueled generator set with a belly mounted fuel tank (the generator set fuel tank appears to have a 209-gallon capacity, which is nominally sized to allow the generator to run for 24 hours at full load). Ventilator equipment and related ductwork also take up space on this level.

The control room has several electrical panels, the generator set transfer switch, ventilation unit controllers, flow meter indicator, and the PS control panel and telemetry panel, as well as indicators for the fixed gas detection system. This room also has a small cabinet for records storage and to provide a place to keep the PS maintenance logs. The control panel has an Allen-Bradley PanelView Plus 1000 HMI, which can be used to view various station information. Level control is displayed from the two Siemens Hydroranger 200 units (one for each side of the wetwell). The Siemens SITRANS FM MAGFLO flow meter (with flow tube located on lower level) displays flows, but the existing circular flow chart recorder is not functional.

Standby Generator Set

The pump level is accessed by a multi-level stair, with the pump level having a floor elevation of approximately -10.5 feet. This level has a sump pit fitted with two sump pumps. Four wastewater pumps and associated suction and discharge valves and piping occupy this lower level. The pump level was originally laid out for only three pumps, and as such this area leaves limited working space for equipment maintenance. The pumps, which are not original, and were replaced c. 2005, include two 'high service' dry-pit submersible KSB Sewatec K150 pumps with 100 hp motors. Based on nameplate, each pump is capable of pumping 2,100 gpm against a total dynamic head of 132 feet.

The two 'low service' pumps (these are normal duty pumps which operate the vast majority of the time) are dry-pit submersible KSB Sewabloc K100 pumps with 30 hp motors. Based on nameplate, each pump is capable of pumping 850 gpm against a total dynamic head of 83 feet. Operators report that these pumps do not achieve the nameplate rating in typical operation.

A couple of pump gauges exist, but none appear functional. Suction and discharge valving include 10-inch gate valves and check valves. The piping and valving are generally in fair condition, with notable corrosion around the threaded flange connections, though a number of sections of piping and valving show more extensive corrosion (e.g., the suction coupling for pump #3). Leaking packing has been a concern on some of the valves.

The following dry-pit observations were made during the site visit:

- The upper entry area is fairly crowded, with the generator set dominating the main room.
- Access to install or remove pumps is challenging due to the lack of a defined vertical lifting space. This requires additional rigging effort to perform significant pump maintenance or replacement.
- While the concrete walls in the PS appear sound, we noted some water infiltration at the lower level. The wet floor areas appear to contribute to piping and pipe support corrosion.
- The dry-pit ventilation system was functional and air flow was observed to be generally good. No verification of air flow rates was performed.
- The day before our visit, pump #2 (normal service) was replaced with a new KSB pump, matching the original model specifications. This pump was in duty on our arrival and ran continuously, discharging approximately 500 gpm with the VFD drive running at ~54.5 Hz. Operators report that this pump also achieves output below the nameplate rating.
- The discharge head losses for the high service pumps appear to have been over-estimated, and the pumps therefore appear to 'run out' on their operating curves – meaning they deliver higher flow rates than name plate due to lower than expected resistance (head loss). Full speed pump runs were not conducted, but a review of reports by others suggest that the high flow pumps may deliver 2,300 gpm to 2,750 gpm when running at full speed. System hydraulics should be confirmed before any further pump replacement work is done.
- The pumps are known to be problematic. The operations staff notes significant concerns with the reliability and service of the KSB pumps, and as the pumps are now ~15 years old, replacement with new equipment will be needed.

- The pipes and valving show signs of corrosion, particularly the suction lines and lower elevation fittings.
- Two of the pump VFDs have been replaced in the past five years, though further upgrades should be considered.
- It is suggested that all corroded equipment, piping, and valves should be switched out at the same time as pump replacement work, to allow more efficient use of isolation work and reduce impact on operations.

Based on the observed motor size (100 hp) of the 'high service' pumps as compared to the generator set (110 kW), it appears that there may be limitations to starting and running these larger pumps during periods of standby power at the station. Appropriate sizing for the generator equipment should be reviewed along with pump and system hydraulics, to ensure that future equipment is sized appropriately.

The Front St PS discharges through a 14-inch diameter ductile iron (DI) force main, with a total length of approximately 4,300 feet, terminating at the headworks of the Marion WPCF at the end of Benson Brook Rd. Per recent coupon analysis, the force main transitions to a 12-inch grey cast iron (CI) pipe just west of Mill St (Route 6), and much of the last 2,600+ feet of the force main to the WPCF is 12-inch diameter. The force main transitions again to 14-inch diameter on the WPCF site, prior to the discharge point into the headworks structure (or to the available lagoon diversion pipe).

Notable concerns for resiliency and vulnerability exist at the Front St PS. In the 2019 vulnerability assessment completed by the Town (refer to Section 2.3.3.9 for further discussion), the Front St PS ranked second highest in vulnerability and second highest in risk among the Town's sewer pump stations. In addition to the significant vulnerability issues related to the force main (discussed above), this station lies in an area of low elevation – with ground level well below the 100-year floor elevation. An item of critical importance is the lack of connections to adequately bypass the station or force main in the event of a system failure.

In June 2021, the Town successfully applied for the Fiscal Year 2022 CZM Grant to complete resiliency improvements at the Front St PS. Consistent with the CZM Grant Application, this project was designed to be constructed in two phases. Phase 1 consisted of the design, bid, and construction of installing a permanent bypass pumping connection at the pump station, replacing the existing combination air release valve on the force main, installing a second tapping sleeve valve on the force main near the intersection of Benson Brook Road and Route 6 and performing an assessment of the force main pipe condition. The force main assessment consisted of taking thickness measurements at accessible locations along the force main, as well as collecting pipe coupons during construction to be sent to a testing agency that underwent general, metallurgical, and chemical analyses to better understand the pipe wall condition. The results confirmed that the 50-year-old pipe, though ultimately not in concerning condition, show signs of age based on corrosion levels measured. Phase 1 was completed in November 2022. Phase 2 consisted of improvements to the building envelope to reduce the risk and damage due to project flood events. Design work was limited to a preliminary level of detail, with work anticipated to be constructed at a future date. Phase 2 was completed in December 2021.

2.3.3.2 Silvershell Pump Station

The following information regarding the Silvershell PS includes observations excerpted from the Final Report of the *Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping*

Infrastructure, prepared by CDM Smith in June 2019, and is supplemented with additional information from Weston & Sampson's observations, review of pumping records and operator discussions.

The Silvershell PS is located at the southwest corner of the intersection of Front and Lewis Streets. The pump station receives flow from approximately 400 properties in its sewershed, a portion of the Village Area, via low pressure sewers (grinder pumps) and gravity sewers. Flow from the PS is conveyed to the Front Street PS tributary sewer on Water Street.

Silvershell PS Building Entrance

The station was initially constructed prior to 1957, but was upgraded in 1969 and again in 2004. The original pump station was a below and above grade structure that housed the wet well on the lower level. As part of the 2004 upgrades, a new circular precast concrete wet well and valve pit were installed outside, southeast of the building. While use of the existing wet well in the building was discontinued (though not filled in), the building was left in place to house the pump control panel. The new wet well and valve pit can be accessed via hatches. The building itself is a single-story, structure with a single access door facing Lewis Street. The pump control panels are attached to the exterior northwest wall of the building behind a chain link fence.

The PS operates with a duplex submersible pumping system (alternating, in lead/lag configuration). The two submersible pumps are manufactured by KSB, have a design flow rating of 300 gpm at an approximate TDH of 26 feet. The pumps are equipped with approximately 5 HP motors that are controlled and automatically cycled by a Harbor Controls controller box, which communicates operating conditions and alarms to the Sewer Department personnel via SCADA. Historically, peak flows can be handled by one pump, and there is no known history of SSOs due to limited pump capacity or pump malfunction.

Pump run time data was reviewed for this PS for calendar years 2019 and 2020. On average, the pumps at the Silvershell PS run a total 3.7 hours per day. Based on nameplate capacity for the pumps, this suggests that existing average daily flows to this PS are approximately 66,000 gallons per day.

Emergency power is supplied by a receptacle mounted inside the upper level of the station for connecting to a trailer-mounted portable generator stored at the DPW garage.

Vehicle access to the site, and specifically for the portable generator, is limited. The wet well in the lower level of the pump station building, which was abandoned in 2004, has not been filled and has accumulated standing water. This station has no dedicated standby generator/automatic transfer switch. Notable corrosion of pipes and valves within the wet well has been

Silvershell Pump Station

observed, including leaking valve stems, and there is noted infiltration in the valve pit. No isolation valve is installed on the force main, and provisions for easier isolation and bypass of the PS are needed.

The Silvershell PS force main extends approximately 1,800 feet from the pump station to the intersection of Water Street and Holmes Street. The 8-inch asbestos cement (AC) force main pipeline was installed c. 1960. While the PS was upgraded c. 2004, no information on the condition of the force main is available. Although condition of the force main is not known, the line should be a notable point of concern based on age alone. An assessment of the force main should be completed in the near future.

Notable concerns for resiliency and vulnerability exist at the Silvershell PS. In the 2019 vulnerability assessment completed by the Town (refer to Section 2.3.3.9 for further discussion), the Silvershell PS ranked fourth highest in vulnerability and fourth highest in risk among the Town's sewer pump stations. In addition to the vulnerability issues related to the force main (discussed above), this station lies in an area of low elevation – with ground level well below the 100-year floor elevation.

2.3.3.3 Creek Road Pump Station

The Creek Road Pump Station was visited for an existing conditions assessment on April 17, 2020 by the Town of Marion operators and Weston & Sampson. The following description of the station is based on observations from this assessment, and additional discussions with operators.

The Creek Road PS is located along the south side of Creek Road, approximately 750 feet east of the intersection of Wareham Rd (Route 6). The PS was constructed in 1972 as part of the Town's Contract 4 Sewer Improvements. The station was upgraded in 2004. The station lies nearby the bank of Briggs Cove and its tributary coastal creeks, with the wetwell located only a few feet from the top of the bank. The entire site is within the coastal floodplain, and consistent with the local service area, lies below the 100-year flood elevation. The PS is a below grade 'dry-pit, wet-pit' type station, constructed of prefabricated concrete.

Creek Road Pump Station

The pump station receives flow from approximately 500 properties within its sewershed, serving East Marion. Additional flows from the Oakdale Avenue PS, Littleneck PS, Parkway Lane PS, Point Road PS, and Stoney Run PS are routed through the Creek Road PS. Flow from the Creek Rd PS is then conveyed to the Front Street PS via an 8-inch cast iron force main.

The wetwell is an 8-foot diameter precast structure with a 30-inch accessway, equipped with a hinged cast iron manhole (MH) frame and cover (nominal 30-inch opening). The locking access cover is gasketed to prevent significant inflow during high water events. A single 12-inch diameter influent gravity line enters (invert elev. -5.70 feet) the wetwell, originating from a sewer MH located in Creek Road. Two 8-inch diameter suction lines, equipped with flared bend fittings, draw water from the bottom of the wetwell. Based on record drawings, the bottom of the wetwell is at approximately elev. -12.7 feet, and the rim of the access cover is at approximately elev. 9 feet, with the ground surface being several inches

lower than the rim. The wetwell is equipped with a system of level control floats, and a Multitrode level transducer, either of which can be selected to control the pump levels.
The following wetwell observations were made during the site visit:


Wetwell Access Hatch at Top of Bank

- Wetwell access via the cast iron cover is challenging and provides limited access for entry/inspection and cleaning.
- Access to the wetwell is generally limited by the location along the bank and surrounding trees/shrubs.
- The influent sewer line is submerged through the observed pump cycles, based on current level settings. This results in a backwater condition of the sewer line, but likely extends the length of pump cycles (thereby reducing pump start frequency).
- There was a small amount of grease (grease balls) observed floating on the wetwell, and the staff suggested this is fairly normal for this station. There was notable grease accumulation on the Multitrode transducer.
- Based solely on observation from above grade, the exposed precast concrete walls of the wetwell appeared to be in good condition.
- Flows to the station were steady during our visit (Friday, around 9 am), and the wetwell did not appear to exhibit significant levels of hydrogen sulfide or other odors.


Intermediate Level of Dry Pit

The dry-pit is comprised of a prefabricated concrete 'peanut can', with a lower pumping level and two intermediate access levels. The concrete access levels extend to approximately 2.5 feet above the surrounding grade, and a roof-type hatch extends an additional 14 inches (approximate) above the concrete top slab. The two concrete access levels each measure approximately 4 feet wide by 8 feet long (inside dimensions). These levels are equipped with offset openings and ladders to access the lower levels. The upper access level holds some small electric service panels and a fire extinguisher, but no significant equipment. The middle access level holds the PS master control panel, dehumidifier, and service panels. This level is very tight considering the need to access for PS status checks, and at least one electrical panel is located directly opposite the entry ladder, providing further limited clearance for access. The control panel has an Allen-Bradley Panelview Plus 1000 HMI, which can be used to view various station information, and allows switching between the Multitrode system and floats for system level control. The pumps auto alternate in lead/standby, and are run on constant speed (no VFDs). There is no flow meter for the station, but run time hours are recorded by the staff. Alarms are transmitted via a radio telemetry system.

The lower pumping level is roughly 6 feet wide by 10 feet long and built with rounded corners. The walls are painted concrete, and the floor is covered with small tiles. This lower level includes two pumps with suction and discharge piping, and associated isolation valves. Ancillary equipment on the lower level includes lighting, unit heater, ventilation fan, and a simplex sump pump system in a small sump. The two pumps are not original and were replaced c. 2007 with new dry-pit submersible pumps - KSB Model

Type KRTBE 100-251/114XG, built together with 15 hp motors. Based on nameplate, each pump is capable of pumping 520 gpm against a total dynamic head of 64.4 feet. The piping and valving are in fair condition, with notable corrosion around the threaded flange connections. According to the staff, the valves are functional, though the position of the operator wheels make the valves a challenge to open and close. Pipe supports against the floor show significant corrosion.

The following dry-pit observations were accounted for during the site visit:

- Access via the multi-level ladder system is difficult and presents a safety challenge as the middle and pump levels cannot be seen from above grade. This is a greater challenge due to the limited number of operations staff in the Marion wastewater department. A recent report on safety notes OSHA concerns for this station related to access.
- The staff noted significant water enters the structure during wet weather, presenting issues for access and equipment.
- The physical size of the structure is very tight, limiting the amount of work that can be comfortably performed inside the station.
- Insufficient clearance is available around the below grade electrical and control panels for panel service work.
- The dry-pit ventilation system was functional and air flow was observed to be generally good. No verification of air flow rates was performed.
- While the concrete walls generally appear sound, the pump level floor and sump area appear degraded.
- The sump is shallow, and the sump pump must be forced to operate (manually) to keep water below the floor level.
- Removing pumps for maintenance or replacement is extremely difficult due to the restricted space and poor access configuration of the station.
- The pumps appear to operate smoothly, with no significant sound or notable vibration.
- The pumps are known to overheat, according to reports from the operators. Plug-in fans are used to help cool pumps off from overheating.
- Pumps are on a constant speed (start-stop) cycle, based on level control with an apparent range of approximately 6-inches vertical (not confirmed) for a typical pump cycle. Observed pump cycles ranged from 3:15 minutes to 3:40 minutes. Total daily run times for the pumps between April 14th and 17th (2020) ranged from ~7 total hours to ~10 total hours.

Historic pump run time data was reviewed for this PS for calendar years 2019 and 2020. On average, the pumps at the Creek Road PS run a total 5.7 hours per day. Based on nameplate capacity for the pumps, this suggests that existing average daily flows to this PS are approximately 180,000 gallons per day.

Above grade components of the PS include a pedestal mounted meter socket, electric service panel, and manual transfer switch, as well as a mast for the radio telemetry system. No permanent generator is located at the site, but a portable generator can be brought to the PS (as needed) and connected to the socket provided below the transfer switch. The raised access to the dry-pit is equipped with a wooden stair system, and four ventilation stacks extend to approximately 9 feet above grade. A fenced enclosure, arranged in a square approximately 35 feet on each side, encloses the dry-pit access, pedestal and vents, and allows for area to park the trailer-mounted generator set. The wetwell access lies outside the fenced enclosure, and the surrounding trees/shrubs may complicate access to the wetwell for cleaning. The site area is generally limited, as the fence line appears to be close along the property limits.


Above-Grade Electrical Panels

The Creek Road PS discharges through an 8-inch diameter cast iron force main, with a length of approximately 4,500 feet, terminating near the intersection of Front St and Wareham Road (Route 6). According to records, there are two air release valve manholes for this force main. One valve manhole is located in front of the business Rose and Vicki's on Wareham Road, approximately 1,200+ feet southwest of Creek Road. The condition of the force main is not known, but based on age alone, the line should be a notable point of concern. An assessment of the force main should is needed.

Notable concerns for resiliency and vulnerability exist at the Creek Rd PS. In the 2019 vulnerability assessment completed by the Town (refer to Section 2.3.3.9 for further discussion), the Creek Rd PS ranked highest in vulnerability and third highest in risk among the Town's sewer pump stations. In addition to the vulnerability issues related to the force main (discussed above), this station lies in an area of low elevation – with ground level well below the 100-year floor elevation. The pump station and wetwell are located in an Effective Velocity (VE) 17 zone, meaning that this location is subject to waves of 3-feet or greater during an effective 1-percent-annual-chance flooding event.

In late 2020, the Town was awarded a CZM grant to complete the design of a replacement for the Creek Rd PS. The work as designed will include a new submersible pump station, with an elevated building to house controls and a standby generator, as well as provisions for bypass of the station if needed. The existing pump station will be demolished at the completion of the project. The design work was completed in June 2021, and the Town is seeking funding to construct the project in the near future.

2.3.3.4 Oakdale Pump Station

The Oakdale PS was visited in May of 2021 by Weston & Sampson to review the existing conditions. The following information regarding the Oakdale PS includes our observations as well as some information excerpted from the Final Report of the *Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure* prepared by CDM Smith in June 2019. This information is further supplemented with additional information from pumping records and operator discussions.

Oakdale Pump Station Control Panel

The Oakdale PS is located approximately 130 feet west of Hammetts Cove, and east of the intersection of Oakdale Avenue and Oakdale Avenue Extension. The pump station receives flow from approximately 60 residential buildings (including a large number of structures located on the adjacent camp property) within its sewershed, primarily made up of gravity sewer lines. Flow from this PS is conveyed to the Creek Road PS via a 4-inch force main. The sewers and force main in this area include pipelines running through the private camp property, and the force main eventually connects to a manhole on Wareham Road near the intersection of Hermitage Road. The Town does not have record drawings for this area, and the existence of sewer easements along the cross-country alignment is uncertain.

Constructed in 1993, this PS consists of a wetwell, a valve pit, and an electrical manhole that is located in an open field near Hammetts Cove. The staff currently uses a manually-cleaned basket installed in the manhole upstream of the wetwell to intercept troublesome debris (typically wipes and gloves). The wetwell is 6-foot diameter, precast concrete and is accessible via a hatch. The valve pit is accessible via a manhole cover. The electrical panels and pump controls are housed in an outdoor electrical pedestal cabinet located off Oakdale Avenue, nearly 1,000 feet west of the wet well and valve pit. The station has the ability to accept backup power from a portable generator via a receptacle at the control, though there is limited space along the roadway for the portable generator to be located.

Oakdale Pump Station Wet Well

The Oakdale PS is a submersible station with a wetwell that consists of two Flygt submersible pumps (one duty/one standby). The pumps have a design flow rate of 240 gpm and a TDH of 35 feet. The pumps are equipped with 4 horsepower (HP) motors, which are controlled and automatically cycled using pump float switches. The control system utilizes a SCADA system to communicate operating conditions with the Sewer Department.

Pump run time data was reviewed for this PS for calendar years 2019 and 2020. On average, the pumps at the Oakdale PS run a total 0.5 hours per day. Based on nameplate capacity for the pumps, this suggests that existing average daily flows to this PS are approximately 7,000 gallons per day.

Considering the age of this pump station, it is in relatively poor condition and presents significant challenges for operation and reliability. The wetwell was poorly constructed, with parts of the precast concrete mis-aligned. Environmental conditions and infiltration have caused corrosion to the mechanical and electrical equipment. The electrical manhole and conduits collect water in the lines. The electrical cabinet location presents a challenge, and the associated wiring and conduits are approaching the end of their useful life. The pump control float system is in poor condition (some out of service), needs replacement. This station does not have the ability to be readily bypassed.

The Oakdale PS force main extends approximately 1,700 feet from the pump station, running cross-country through the camp property, and discharging to a manhole on the south side of Wareham Road, just northeast of the intersection of Hermitage Road. The 4-inch force main pipeline (which according to drawings is 4-inch ductile iron pipe) was installed with the PS around 1993, but no information on the condition of the force main is available. The location of the force main through the cross-country area needs to be confirmed, and Town easements should be located or established.

Notable concerns for resiliency and vulnerability exist at the Oakdale PS. In the 2019 vulnerability assessment completed by the Town (refer to Section 2.3.3.9 for further discussion), the Oakdale PS ranked third highest in vulnerability and highest in risk among the Town's sewer pump stations. This station lies in close proximity to the coastline, in an area of low elevation – with ground level well below the 100-year floor elevation. The wetwell and valve pit are located in an Effective Velocity (VE) 17 zone, meaning that this location is subject to waves of 3-feet or greater during an effective 1-percent-annual-chance flooding event.

2.3.3.5 Littleneck Pump Station

The Littleneck PS was visited in May of 2021 by Weston & Sampson to review the existing conditions. The following information regarding the Littleneck PS includes our observations as well as some information excerpted from the Final Report of the Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure prepared by CDM Smith in June 2019. This information is further supplemented with additional information from pumping records and operator discussions.

The Littleneck PS is located within Littleneck Village, off of Wareham Road. Currently, this station serves the five buildings in the surrounding Littleneck Village housing development, plus approximately 10 properties on Hermitage Road and Oakdale Avenue. Flow from this station is conveyed via an approximately 650-foot, 4-inch force main to a sewer manhole near the intersection of Hermitage Lane and Route 6. From here, flow is transferred to an 8-inch gravity sewer on Route 6 and then to the Creek Road Pump Station.

Littleneck Pump Station

Constructed by the housing complex developer in 2011, this station consists of a duplex submersible-type station with a precast concrete wetwell, with a

valve pit and above ground electrical controls. The wetwell is a large rectangular tank, accessed via two metal hatches with deep concrete risers (located on either end of the wetwell). Pump float switches provide control of the two pumps. The valve pit is also accessible via a hatch, located east of the wetwell. The valve vault is large (approximately 8-feet by 8-feet, and 8-feet deep) and in generally good condition, though the check valves were installed downstream of the isolation gates on each line – making it impossible to isolate the checks for maintenance.

The pump station operates with a duplex submersible pumping system (one duty/one standby). The two submersible pumps are manufactured by Flygt and have a design flow rate of 240 gpm and a TDH of 35 feet. The pumps are equipped with approximately 4 HP motors that are controlled and automatically cycled by an above ground Harbor Controls controller box (the Allen-Bradley Panelview HMI is a replacement unit). The control system communicates operating conditions and alarms to the Sewer Department via radio telemetry. The station has the ability to accept backup power from a portable generator via a receptacle on the control panel. The station power is also supported by a dedicated generator set that serves the housing complex.

Pump run time data was reviewed for this PS for calendar years 2019 and 2020. On average, the pumps at the Littleneck PS run a total 0.5 hours per day. Based on nameplate capacity for the pumps, this suggests that existing average daily flows to this PS are approximately 7,000 gallons per day.

The PS location is challenging. The pump station does not have any protective barriers installed and is located in an island in the middle of the parking lot for the housing development. Vehicles for the residences are often parked in close proximity to the PS structures. This configuration makes accessing the wetwell for maintenance more difficult. The controller box and electrical panels are exposed to the weather conditions. The wetwell configuration is a major concern – the deep and relatively narrow access risers limit access and maintenance of the tank. This also places the level control floats in close proximity to the pumps, which has proven problematic. This station also experiences issues due to non-flushables, grease, and floatables interfering with pump and pump float operations (the wetwell had been cleaned one month before our visit, and notable solids had already re-accumulated in the wetwell). Because the wetwell is the location of the submersible pumps, the wetwell issues are a significant concern.

The Littleneck PS force main runs east (cross-country) to Hermitage Road, then north along Hermitage Road, discharging to a gravity manhole on the south side of Wareham Road (Route 6). This is the same manhole that receives discharge from the Oakdale PS force main. The force main is approximately 650 feet long, and part of the line was installed new at the time the Littleneck PS was constructed (c. 2011). Based on information from Town staff, part of the older force main from the previous pump system serving this area was kept in service, and as such that segment predates the newer force main. The newer part of the force main is constructed of PVC pipe, while the older section of the line is Transite (AC) pipe.

Limited concerns for resiliency and vulnerability exist at the Littleneck PS. In the 2019 vulnerability assessment completed by the Town (refer to Section 2.3.3.9 for further discussion), the Littleneck PS ranked lowest in vulnerability and lowest in risk among the Town's sewer pump stations. This station lies within 700 feet of the coastline, in an area of relatively low elevation. With its lowest elevation of approximately 16.3 feet, the station is located in an AE 15 flood zone, meaning the area around the PS is subject to waves of less than 1.5 feet during an effective 1-percent-annual-chance flooding event.

2.3.3.6 Parkway Lane Pump Station

The Parkway Lane Pump Station was visited in May of 2021 by Weston & Sampson to review the existing conditions. The following information regarding the Parkway Lane PS includes our observations as well as some information excerpted from the Final Report of the Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure prepared by CDM Smith in June 2019. This information is further supplemented with additional information from pumping records and operator discussions.

Parkway Lane PS Wetwell

The Parkway Lane Pump Station is located on Parkway Lane between #23 Parkway Lane and #19 Parkway Lane. The site is surrounded by an aging wooden fence, which separates the PS structures from an adjacent walking path. This is a submersible pumping station with above ground electrical controls located approximately 10 feet off Parkway Lane. The pumping station collects flow from approximately 20 residential homes along Parkway Lane. Flow from this pump station is sent to the Creek Road Pump Station via gravity sewers on Route 6.

Constructed in 1986, the pump station consists of a circular precast concrete wet well and above ground electrical controls. The circular precast concrete wet well is 6 feet in diameter and is accessed via a metal hatch. Pump float switches provide control of the two pumps. There is no dedicated valve vault - all valves are located in the wet well. The station has ball check valves, installed vertically, and hand-wheel operated gate valves for isolation. However, the inaccessible location of the isolation valves makes these valves effectively useless. The pump rails are galvanized steel and are deteriorating – the operators note that the rails are warped, making pump retrieval difficult.

Parkway Lane PS Electrical and Control Panels

Operators noted that solids can be a problem at this PS, and a manual catch basket (milk crate) has been used in the manhole in front of the PS to intercept solids from parts of the gravity sewer system.

The pump station operates with a duplex submersible pumping system (one duty/one standby). The two submersible pumps are manufactured by Barnes and have a design flow rate of 135 gpm and an approximate TDH of 25 feet. The pumps are equipped with approximately 3 HP motors that are controlled and automatically cycled by an above ground, stainless steel controller box. The controller box is original to the station, and the manufacturer is unknown. The control and electrical enclosures are outdated and are not watertight. Controls show significant effects of age and moisture. Power and control wiring between the wetwell and panels are jammed into undersized conduit, making wiring changes impossible. The control system communicates operating conditions and alarms to the Sewer Department personnel via radio telemetry.

Historically, peak flows are easily handled by one pump, and there is no known history of SSOs due to limited pump capacity or pump malfunction. This station can be connected to a portable generator, though dedicated space is not available on the site for the portable unit.

Pump run time data was reviewed for this PS for calendar years 2019 and 2020. On average, the pumps at the Parkway PS run a total 0.7 hours per day. Based on nameplate capacity for the pumps, this suggests that existing average daily flows to this PS are approximately 6,000 gallons per day.

Some concerns for resiliency and vulnerability exist at the Parkway Lane PS. In the 2019 vulnerability assessment completed by the Town (refer to Section 2.3.3.9 for further discussion), the Parkway Lane PS ranked sixth highest in vulnerability and fifth highest in risk among the Town's sewer pump stations. This station lies within 1,000 feet of the coastline, in an area of relatively low elevation. With its lowest elevation of approximately 12.7 feet, the station is located in an Effective AE 16 flood zone, meaning the PS is subject to waves of less than 1.5 feet during an effective 1-percent-annual-chance flooding event.

The Parkway PS force main extends approximately 600 feet from the PS to a gravity sewer manhole on the north side of Wareham Road (Route 6). The 4-inch diameter force main was installed new at the time the Parkway PS was constructed (c. 1986).

2.3.3.7 Point Road Pump Station

The following information regarding the Point Road Pump Station includes observations excerpted from the Final Report of the *Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure* prepared by CDM Smith in June 2019, and is supplemented with additional information from Weston & Sampson's observations, review of pumping records and operator discussions.

The Point Road Pump Station is located west of the intersection of Point Road and Bullivant Farm Road and is accessible via gravel driveway. Flow to this station is collected from approximately 90 homes (including the private sewer system serving the Bullivant Farm area) and is pumped to a sewer manhole at the intersection of Barros Drive and Point Road, which ultimately flows to the Creek Road Pump Station. The Point Road Pump Station consists of a building structure, circular precast wetwell, and valve pit.

Point Road Pump Station

The Point Road Pump Station was originally constructed in the early 1970s as a sewer ejector station, but was upgraded in the mid-2000s to a submersible pump station. The building, originally constructed for the ejector station compressor system, is now used for Sewer Department storage, and control equipment is mounted on the building. The valve pit, a concrete structure elevated above the surrounding ground level, was originally part of the ejector structure and now houses pump discharge valves. The elevated hatch configuration (and opening direction) make access to the structure difficult. In general, the vault is in poor condition, and

the old ejector system was not fully abandoned when the new submersible PS was installed. The old equipment remaining on the vault's lower level creates a safety concern for operations staff.

The circular precast concrete wet well can be accessed via a hatch. The pumping station operates with a duplex submersible pumping system (one duty/one standby). The two submersible pumps are manufactured by KSB and have a design flow rate of 120 gpm and a TDH of 25 feet. The pumps are equipped with approximately 3.5 HP motors that are controlled and automatically cycled by an indoor, stainless steel controller box. The control panel is manufactured by Harbor Controls and uses a MultiTrode control system. The control system communicates operating conditions and alarms to the Sewer Department personnel via radio telemetry. Historically, peak flows can be handled by one pump, and there is no known history of SSOs due to limited pump capacity or pump malfunction. This station has the ability to be connected to a portable generator via a receptacle on the face of the building. Significant grease accumulation has been a continuing problem at this PS.

Pump run time data was reviewed for this PS for calendar years 2019 and 2020. On average, the pumps at the Point Road PS run a total 2.7 hours per day. Based on nameplate capacity for the pumps, this suggests that existing average daily flows to this PS are approximately 19,000 gallons per day.

The Point Road PS force main extends approximately 900 feet from the pump station eastward along Point Road to the intersection of Barros Drive. The 4-inch diameter force main pipeline was installed with the original pneumatic ejector pump station in the early 1970's. While the PS was upgraded c. 2004, no information on the condition of the force main is available. Although condition of the force main is not known, the line should be a notable point of concern based on age alone.

Some concerns for resiliency and vulnerability exist at the Point Road PS. In the 2019 vulnerability assessment completed by the Town (refer to Section 2.3.3.9 for further discussion), the Point Road PS ranked second lowest in vulnerability and third lowest in risk among the Town's sewer pump stations. While this station lies more distant from the coastline, it is within 100 feet of the adjacent cranberry bog, and in an area of relatively low elevation. With its lowest elevation at approximately 15.3 feet, the pump station is located in Effective AE 16 zone, meaning that this area is subject to waves of less than 1.5 feet during an effective 1-percent-annual-chance flooding event.

2.3.3.8 Stoney Run Pump Station

The Stoney Run Pump Station was visited in May of 2021 by Weston & Sampson to review the existing conditions. The following information regarding the Parkway Lane PS includes our observations as well as some information excerpted from the Final Report of the Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure prepared by CDM Smith in June 2019. This information is further supplemented with additional information from pumping records and operator discussions.

Stoney Run Pump Station is located is located across the street from #45 Stoney Run Lane, east of the Edgewater Lane and Stoney Run Lane intersection. Flow to the station is collected from approximately 30 homes on Stoney Run Lane and Edgewater Lane and is pumped to a sewer manhole west of the intersection of Delano Road and Stoney Run Lane. Flow from the Stoney Run Pump Station is then sent to the Creek Road Pump Station.

Constructed in 1995, the Stoney Run pumping station is a submersible station with a wet well, valve pit and above ground electrical controls. The 8-foot diameter circular precast concrete wet well is by accessed via a hatch. Pump float switches provide control of the two pumps. The valve pit is a circular precast concrete structure that can also be accessed via a hatch. The valve pit has been subject to notable groundwater intrusion, and a sump pump must be used manually to dewater the vault. The PVC sump discharge line is part of the leakage source as water runs back to the vault from this line.

Stoney Run Pump Station Hatches

Electrical and Control Panels

The pumping station operates with a duplex submersible pumping system (one duty/one standby). The submersible pumps are Barnes, and are run on single phase power. Each submersible pump has a design flow rate of approximately 295 gpm at a TDH of 25 feet. The pumps are equipped with approximately 5 HP motors which are controlled and automatically cycled by an above ground, stainless steel controller box. The controller box is original to the station and the manufacturer is unknown. Power and control wiring between the wetwell and panels are jammed into undersized conduit, making wiring changes impossible. Because of the limited conduit available, fewer floats are available for pump control at the PS. The control system communicates operating conditions and alarms to the Sewer Department personnel via radio telemetry. Historically, peak flows can easily be handled by one pump and there is no known history of SSOs due to limited pump capacity or pump malfunction. This station has the ability to hook up to a portable generator.

Pump run time data was reviewed for this PS for calendar years 2019 and 2020. On average, the pumps at the Silvershell PS run a total 0.6 hours per day. Based on nameplate capacity for the pumps, this suggests that existing average daily flows to this PS are approximately 11,000 gallons per day.

The Stoney Run PS force main runs approximately 1,350 feet along Stoney Run Lane and turns onto Delano Road, discharging to a gravity manhole just west of the intersection on Stoney Run Lane. The 4-inch diameter force main was installed new at the time the Stoney Run PS was constructed (c. 1995).

Limited concerns for resiliency and vulnerability exist at the Stoney Run PS. In the 2019 vulnerability assessment completed by the Town (refer to Section 2.3.3.9 for further discussion), the Stoney Run PS ranked fifth highest in vulnerability and second lowest in risk among the Town's sewer pump stations. This station lies within 800 feet of the Weweantic River, in an area of relatively low elevation. With its lowest elevation at approximately 14.9 feet, the pump station is located in Effective AE 16 zone, meaning that this area is subject to waves of less than 1.5 feet during an effective 1-percent-annual-chance flooding event.

2.3.3.9 Pump Station Coastal Resiliency

As referenced previously, in 2019, CDM Smith completed a report, *Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure*, which presented a summary of the vulnerability and risk assessment of Marion's pump stations and grinder pump neighborhoods.

CDM Smith mapped potential inundation in Marion to define the probability of flooding at any of the pump station locations. The impact of climate change on sea level rise was also considered. To determine the pump stations that are most vulnerable to coastal flooding, each pump station was evaluated across seven categories of potential impact on a five-point scale from (1) no to low impact to (5) high impact. A vulnerability summary table shows the impact categories and vulnerability scoring in Table 2-13.

Table 2-13: Pump Station Vulnerability Assessment Summary (CDM Smith 2019)

Pumping Station	Impact to Pumping Station Equipment	Impact to Pumping Station Structure	Impact to Wastewater System Operations	Impact to Critical Facilities	Impact to Cultural and Historic Areas	Impact to Private Properties	Impact to Environmental Resources	Exposure (Sum of Impacts)	Adaptive Capacity	Vulnerability (Sum of Exp. + Adaptive Capacity)	Vulnerability Rank
Front Street	4.4	4	5	5	5	5	1	29.4	2	31.4	2
Silvershell	4.1	4	3	1	3	4	1	20.1	3	23.1	4
Creek Road	5.0	5	4	2	4	5	5	30.0	3	33.0	1
Point Road	4.1	2	1	1	1	3	2	14.1	3	17.1	7
Littleneck	2.1	1	2	1	2	2	3	13.1	3	16.1	8
Oakdale	3.8	5	2	1	4	3	5	23.8	5	28.8	3
Parkway	3.4	3	1	1	1	1	4	14.4	5	19.4	6
Stoney Run	3.5	1	3	1	1	2	3	14.5	5	19.5	5

The flood risk of each pump station was further determined as the product of the pump station's vulnerability and its probability of flooding. A similar evaluation was performed for three grinder pump neighborhoods. Table 2-14 shows the risk for each pump station.

Table 2-14: Risk Ranking by Pumping Station based on Equal and Preferential Weight (CDM Smith 2019)

Pumping Station	Risk Score (Equal Weight)	Risk Score (Preferential Weight)	Risk Rank
Oakdale	5.40	0.54	1
Front Street	3.72	0.51	2
Creek Road	2.90	0.33	3
Silvershell	0.77	0.09	4
Parkway	0.34	0.04	5
Point Road	0.16	0.02	6
Stoney Run	0.11	0.01	7
Littleneck	0.07	0.01	8

Overall, resiliency is a major concern for many of Marion's pump stations and planning for improved system resiliency is a clear recommendation of the report findings.

Numerous mitigation measures were considered as part of this study, but all fit into four major categories:

- Prevent pump stations from flooding.
- Protect critical components if pump stations become flooded.
- Maintain lift station operations when the electrical grid is offline.
- Have a means of bypassing the normal lift station operations when necessary.

Mitigation measures from all of these categories were considered for each of Marion's eight pump stations. A detailed list of recommendations can be found in the report, but an abbreviated list is presented in Table 2-15 below:

Table 2-15: Mitigation Measures Alternatives Summary (CDM Smith 2019)

Mitigation Measure	Oakdale	Front Street	Creek Road	Silvershell	Parkway Lane	Point Road	Stoney Run	Littleneck
Install and elevate new electric cabinet above DFE[1]	X	X	X	X	X	X	X	X
Reseal any subgrade electrical connections in electrical manhole	X							
Relocate electric meter to above DFE	X							
Relocate electric devices above DFE in watertight enclosure	X							
Construct new pumping station structure		X	X	X		X		
Construct second floor encapsulated addition and entrance above DFE		X						
Install new influent sluice gate with automatic actuator		X						
Elevate odor control equipment and venting above DFE		X						
Construct a trip wall to break down waves		X						
Install permanent generator above DFE			X					
Install submersible pumps			X					
Replace vent to extend above DFE			X					
Replace existing covers with a watertight hatch			X					
Implement bypass pumping [2]	X	X	X	X	X	X	X	X
Transition a neighborhood to individual grinder pumps and low pressure sewers [2, 3]								

[1] DFE = Design Flood Elevation
[2] These mitigation options are alternatives that need additional analysis to assess feasibility on a station by station basis.
[3] The 2019 report did not identify any stations with this mitigation option, but discussion with staff suggests that this approach may be relevant to the Parkway Lane PS.

2.3.4 *Private Sewer Collection Systems*

The Town's collection system receives flow from a number of private sewer collection systems (at least 16 areas have been identified by the CWMP review), serving approximately 130 residences. These private collection systems were constructed by developers and transmit flow to the Town's system, but operations and maintenance of these systems (pipeline and pumps) are the responsibility of those served by the private system or associations that represent these areas. Like any other connection,

these private systems are subject to the Town's Sewer Use Regulations. Three pump stations exist within private sewer systems: the Marion Village PS (a Gorman-Rupp suction lift station), and two smaller systems that serve single buildings (Sippican PS, serving a building on the Lockheed property, and the Racquet Club PS). A summary of the private collection systems and where they tie into the Town's collection system is presented in Table 2-16.

Table 2-16: Private Sewer Collection System Descriptions

Private System	Sewershed	Tributary Pump Station (PS)	Composition	Connects to (Town-Owned)
Rezendes Terrace	C-3	Creek Road PS	185' of 8-inch LP	Point Road 10-inch
Rebecca Drive	C-4	Creek Road PS	754' of 8-inch LP	Point Road 8-inch
Barros Drive	C-6	Creek Road PS	Unknown	Point Road 8-inch
Whynot Court	C-6	Creek Road PS	Unknown	Point Road 8-inch
Jerei Lane	C-7	Creek Road PS	Unknown	Wareham Road 8-inch
Hammetts Cove Road @ Point Road	LP-3	Creek Road PS	4,130' of 2-inch LP	Wareham Road 8-inch
Cross Neck Road @ Point Road	LP-4	Creek Road PS	1,350' of 2-inch LP	Point Road 8-inch via TJ Walker line
Point Road (TJ Walker)	LP-4	Creek Road PS	8,625' of 2-inch to 2.5-inch LP	Point Road 8-inch
Pawkechatt Way	F-1	Front Street PS	1,025' of 6-inch LP	Front Street 8-inch
Cottage Lane	F-4	Front Street PS	310' of 6-inch LP	Cottage Street 6-inch
Tabor Academy (multiple discharge locations)	F-6	Front Street PS	Multiple	Front Street 10-inch and 12-inch
Industrial Park/ Lockheed Martin	F-6	Front Street PS	2 private PS (Sippican & Racquet Club) that discharge to 930' to 8-inch	Town-owned easement sewer across Tabor Academy to 10-inch sewer
Intersection of Front Street and Route 6	F-8	Front Street PS	LP and 6-inch PVC gravity	Route 6 (Wareham Road) 15-inch
Marion Village Estates	LP-1	Front Street PS	1 private PS	Front Street 10-inch Clay
Old Knoll	LP-5	Front Street PS	13,300' of 1.4-inch to 4-inch LP	Converse Road 8-inch
Bell Guzzle Lane	S-2	Front Street PS	700' of 6-inch LP	Front Street 8-inch

The wastewater from any building that is connected to a private collection system is eventually routed to the Town's collection system and ultimately treated at the WPCF. Therefore, flow measurements at the WPCF include flow from all properties currently connected to private collection systems. However, there are more than 120 possible future buildings/dwellings that front a private sewer and therefore have the ability to ultimately contribute flow to the Town's collection system, and increase capacity demands at the WPCF. A preliminary build-out analysis was conducted for such parcels based on known private sewer connections and factors that affect future development, such as zoning, wetland restrictions, and flood plain analysis. The results of the preliminary build out analysis are presented in Table 2-17. There are, however, restrictions on connecting to a private system. The Town must approve such a connection. Therefore, while there are more than 120 possible connections, the Town would not expect all of these potential connections within the planning period of this report.

Table 2-17: Private Sewer Build Out Analysis

Private System	Sewershed	Tributary System	Approximate No. Existing Units	Approximate No. Buildout Total Units	Zoning	Existing Volume (GPD)[1]	Buildout Volume (GPD)[1]
Rezendes Terrace	C-3	Creek Road PS	11	11	Res. C	2,420	2,420
Rebecca Drive	C-4	Creek Road PS	7	7	Res. C	1,540	1,540
Barros Drive	C-6	Creek Road PS	7	7	Res. A	1,540	1,540
Whynot Court	C-6	Creek Road PS	2	2	Res. A	440	440
Jerei Lane	C-7	Creek Road PS	5	5	Res. A	1,100	1,100
Hammetts Cove Road @ Point Road	LP-3	Creek Road PS	9	16	Res. D	1,980	3,520
Cross Neck Road @ Point Road	LP-4	Creek Road PS	6	10	Res. D	1,320	2,200
Point Road (TJ Walker)	LP-4	Creek Road PS	14	49	Res. D	3,080	10,780
Pawkechatt Way	F-1	Front Street PS	10	10	Res. C	2,200	2,200
Cottage Lane	F-4	Front Street PS	7	7	Res. C	1,540	1,540
Tabor Academy (multiple discharge locations)	F-6	Front Street PS	11	18	Res. C	2,420	3,960
Industrial Park/ Lockheed Martin	F-6	Front Street PS	12	12	Gen. Bus.	2,640	2,640
Intersection of Front Street and Route 6	F-8	Front Street PS	2	5	Gen. Bus.	440	1,100
Marion Village Estates	LP-1	Front Street PS	43	43	Gen. Bus.	15,900	15,900
Old Knoll	LP-5	Front Street PS	39	86	Res. C & D	8,580	18,920
Bell Guzzle Lane	S-2	Front Street PS	6	10	Res. A	1,320	2,200
		Total	191	255		48,460	72,000

[1] Estimated flow based on 220 GPD per residential household unit, 267 GPD per general business unit.

2.3.5 *Grinder Pumps*

2.3.5.1 Grinder Pump Areas

As discussed previously, low pressure sewer systems have been constructed in areas of Marion where gravity sewer systems were deemed impractical and/or uneconomical. These systems generally include an individual grinder pump at each source. There are currently approximately 500 grinder pump units within the municipal sewer system, connecting to 8.5 miles of low pressure sewer ranging in diameter from 1-1/2-inch to 4-inch. These low pressure sewer areas consist of:

- Upper Front Street (LP-1)
- Delano Road/Dexter Beach (LP-2)
- Converse Road (LP-6)
- Bullivant Farm Road & River View Lane (C-1) – Privately Owned
- Hastings Road (C-7) – Privately Owned

A key issue related to the grinder pumps that were installed (and are maintained) by the Town is the age of these systems. The Town low pressure sewer projects (areas LP-1, LP-2 and LP-6) were completed approximately 15 years ago. The pump systems that were installed are therefore nearing the end of their normal expected service life. While many grinder pumps have been repaired, and some have been replaced entirely, the age of these systems is a key concern for the Town.

Within these existing systems there are an additional 89 fronted lots that have the ability to connect in the future. A breakdown of these grinder pump areas that are considered part of the municipal system (versus private) is provided in the following table.

Table 2-18: Grinder Pump Areas (Municipal Sewer System)

Sewershed	Low Pressure Sewer Length (ft)	Existing Grinder Pumps	Potential Future Grinder Pumps	Total Future Grinder Pumps
LP-1	10,860	120	20	140
LP-2	12,100	144	31	175
LP-6	13,500	182	38	220
C-1	1,250	19	0	19
C-7	200	2	0	2
Overall	38,000 (7.2 miles)	467	89	556

In addition to the municipal system, there are also a number of existing private systems which include an additional 68 existing grinder pumps and 93 fronted lots which could connect to the private system at any time, including the following areas:

- Hammetts Cove Road @ Point Road (LP-3)
- Cross Neck Road & Point Road (LP-4)
- Old Knoll Road (LP-5)

A breakdown of the grinder pumps in these private systems is provided in the following table.

Table 2-19: Grinder Pump Areas (Private Sewer System)

Sewershed	Low Pressure Sewer Length (ft)	Existing Grinder Pumps	Future Grinder Pumps	Total Potential Grinder Pumps
LP-3	4,100	9	7	16
LP-4	10,000	20	39	59
LP-5	13,300	39	47	86
Overall	27,400 (5.2 miles)	68	93	161

A current combined breakdown of grinder pumps within the municipal (Town-owned) and private sewer systems, including existing units and potential future units, is provided in the following table.

Table 2-20: Total Grinder Pumps in Marion

Sewershed	Low Pressure Sewer Length (ft)	Existing Grinder Pumps	Future Grinder Pumps	Total Potential Grinder Pumps
Municipal	38,000	467	89	556
Private	27,400	68	93	161
Overall	65,400 (12.4 miles)	535	182	717

2.3.5.2 Ownership, Operation and Maintenance

In general, it is common practice that for all properties fronted by a municipal sewer (gravity or low pressure), a Town installs a wye or tee branch in the sewer main in the public way and extends a service connection stub from the sewer main to the property line of the abutting property for future connection to the municipal sewer. This future connection is typically the responsibility of the individual property owners at their own expense. For properties requiring a grinder pump to connect to municipal sewer, there are varying sentiments on the fairness/equity of service provided to these homes in comparison to properties being provided with a gravity sewer connection. For this reason, municipal policies in regard to the procurement, installation and ownership of individual on-lot grinder pumps, including operation and maintenance responsibilities, vary widely from one community to another.

As per common practice, the Town of Marion is responsible for the operation and maintenance of the public collection system in Town rights-of-way (and established easements) but is not generally responsible for the service connections on private property that connect to the municipal infrastructure. With regard to grinder pumps, however, the Town does currently maintain the pumps for all properties in the municipal sewer service area that were served by the low pressure sewer projects when built (a.k.a. the Expansion Service Area). This policy was established after a lengthy public outreach process, including opinion poll and connection questionnaire mailings, neighborhood and public meetings, and multiple Town Meeting votes. The initial intent/vote was to move forward with purchase of the pumps by the Town with homeowner installation and ownership, but political pressure resulted in a second/revised Town Meeting vote providing for installation and maintenance of the grinder pump units at significant cost to the Town. In conjunction with the final approved policy, the Town also has some responsibility for the pressure service connections beyond 10-feet from the foundation.

As part of the final approved policy/plan, the Town secured a 5-year manufacturer warranty on the pump units, and a renewable 10-year service contract with a local representative (F.R. Mahony & Assoc.) of the grinder pump units for maintenance of the grinder pump systems within the Town's Expansion Service Areas. As per the Town's Sewer Use Regulations, "if a problem is found to be traceable to causes not inherent with the pump and controls, but due to misuse or other reasons … the resulting repair service call could be charged back to the property owner on the water/sewer bill." This process/procedure has proven to be challenging and time consuming for Sewer Department staff in making determinations and billing out costs appropriately. Furthermore, although private grinder pumps for properties outside of the Expansion Service Area are not covered under the current policy, the Sewer Department still fields and responds to inquiries and requests from these property owners.

2.3.5.3 Costs Incurred

With completion of construction in the Expansion Service Area occurring in Fall 2006 and remaining 5-year warranties expiring in the Fall of 2011, the initial 10-year service agreements are due for renewal. Information on complaints/inspections for gravity sewer connections are tracked through the MUNIS work order system but those for grinder pumps are tracked separately and complaints not resulting in a work order are not tracked. According to Sewer Department records, from calendar year 2013 through 2020, the Sewer Department completed 440 significant contracted repairs for the E/One grinder pumps under Town responsibility. The repairs tend to range from minor repair and parts replacement to complete replacement of the pumps – therefore with costs running from a few hundred dollars to over $2,000 at each grinder pump location. Over this period, the Town's grinder pump repairs and annual costs associated with these grinder pump repairs are presented in Table 2-21.

Table 2-21: Grinder Pump Service Calls and Costs [1]

Year	Service Calls	Repair Cost	Avg. Cost per Repair
2013	51	$27,543	~$540
2014	49	$32,567	~$670
2015	64	$61,185	~$960
2016	68	$55,132	~$810
2017	49	$64,362	~$1,320
2018	63	$55,009	~$880
2019	44	$35,803	~$820
2020	52	$54,594	~$1,050
8-year Summary	**440**	**~ $386,000**	**~$880**

[1] The service calls summarized in this table exclude minor items such as replacement covers and gaskets and service gate box replacement.

Based on the above information, the current average annual cost to maintain the low pressure sewer systems is increasing. As the low pressure sewer systems expand and the existing pumps age, it is anticipated that mean time between service calls will decrease, and the average annual maintenance costs will increase. In fiscal year (FY) 2020, Marion allocated $70,000 for all grinder pump maintenance.

2.4 Existing Wastewater Treatment Facility Description and Condition

Based on available records, wastewater treatment and disposal activities have occurred on the current Marion WPCF site since the 1920's or earlier. Marion's current WPCF was principally constructed in 1969 and has been upgraded over time. The last major upgrade of the WPCF was in 2005, when the current SBR system was built. The facility is currently nearing completion of an improvements project as of summer 2021.

2.4.1 *NPDES Permit Limits*

The Town of Marion is currently authorized to discharge treated effluent from the WPCF to an "Unnamed Brook at Aucoot Cove" (sometimes referred to as Giffords Brook) under the National Pollution Discharge Elimination System (NPDES) Permit No. MA0100030, issued by the Environmental Protection Agency on April 13, 2017. This permit is included in Appendix C. The current permit period is due to expire on June 30, 2022 based on the permit issuance date, though the Town understands that the permit effective date was extended, and as such the current permit is effective through November 30, 2022.

The permit regulates effluent limits and monitoring requirements for flow, 5-day Biological Oxygen Demand (BOD_5), Total Suspended Solids (TSS), pH, Fecal Coliform, Enterococci, Dissolved Oxygen, Whole Effluent Toxicity parameters (including total cadmium, lead, copper, zinc, nickel, and aluminum), Ammonia-Nitrogen, Total Nitrogen, Total Phosphorus, and Total Copper. Measurable discharge limits from the current permit are presented in Table 2-22.

Table 2-22: NPDES Permit No. MA0100030 Requirements

Parameter	Discharge Limits			Measurement Type
	Avg. Monthly	Avg. Weekly	Max. Daily	
Flow (MGD)	0.588	-	Report	Continuous Recorder
BOD_5 (mg/L)	9	13	Report	1x/Week; 24hr Composite
BOD_5 (lbs/day)	42	63	-	1x/Week; 24hr Composite
TSS (mg/L)	9	13	Report	1x/Week; 24hr Composite
TSS (lbs/day)	42	63	-	1x/Week; 24hr Composite
pH Range (SU)	6.5 – 8.3 (at any time)			1x/Day, Grab
Fecal Coliform (cfu/100mL)	14	-	28	2x/Week; Grab
Enterococci (cfu/100mL)	35	-	276	2x/Week; Grab
Dissolved Oxygen (mg/L)	≥ 5.0			1x/Week; Grab *June 1 – October 31
Whole Effluent Toxicity (μg/L) Total Cadmium Total Lead Total Copper Total Zinc Total Nickel Total Aluminum	-	-	Report	4x/Year; 24-Hour Composite
Ammonia Nitrogen (mg/L)	2.6	-	Report	1x/Week; 24hr Composite *May 1 – May 31
	1.74	-	Report	1x/Month; 24hr Composite *June 1 – October 31

Parameter	Discharge Limits			Measurement Type
	Avg. Monthly	Avg. Weekly	Max. Daily	
	Report	-	Report	1x/Week; 24hr Composite *November 1 – April 30
Ammonia Nitrogen (lbs/day)	12.75	-	-	1x/Week; 24hr Composite *May 1 – May 31
	8.53	-	-	1x/Week; 24hr Composite *June 1 – October 31
	Report	-	-	1x/Month; 24hr Composite *November 1 – April 30
Total Nitrogen (mg/L) [1]	4.0 [1]	-	Report	3x/Week; 24hr Composite *April 1 – October 31
	Report	-	Report	1x/Month; 24hr Composite *November 1 – March 31
Total Nitrogen (lbs/day) [1]	19.6 [1]	-	Report	3x/Week; 24hr Composite *April 1 – October 31
	Report	-	Report	1x/Month; 24hr Composite *November 1 – March 31
Total Kjeldahl Nitrogen (mg/L)	Report	-	Report	3x/Week; 24hr Composite *April 1 – October 31
Total Kjeldahl Nitrogen (lbs/day)	Report	-	Report	3x/Week; 24hr Composite *April 1 – October 31
	Report	-	Report	1x/Month; 24hr Composite *November 1 – March 31
Total Nitrate + Nitrite (mg/L)	Report	-	Report	3x/Week; 24hr Composite *April 1 – October 31
Total Nitrate + Nitrite (lbs/day)	Report	-	Report	3x/Week; 24hr Composite *April 1 – October 31
	Report	-	Report	1x/Month; 24hr Composite *November 1 – March 31
Total Phosphorus (µg/L) [2]	200 [2]	-	Report	1x/Week; 24hr Composite *April 1 – October 31
	Report	-	Report	1x/Month; 24hr Composite *November 1 – March 31
Total Phosphorus (lbs/day) [2]	0.98 [2]	-	-	1x/Week; 24hr Composite *April 1 – October 31
	Report	-	-	1x/Month; 24hr Composite *November 1 – March 31
Total Copper (µg/L) [2]	7.7 [2]	-	11.3 [2]	1x/Week; 24hr Composite

[1] The Total Nitrogen limits in the permit are rolling seasonal averages, not monthly limits.
[2] The phosphorus and copper limits are currently stayed by compliance orders (the AO and AOC/ACO). There is an interim copper limit of 20 ug/l.

2.4.2 *Current WPCF Flows and Loads*

As part of developing this CWMP, Weston & Sampson reviewed data documented on the Discharge Monitoring Reports (DMRs) submitted to EPA between January 2017 and December 2021. This data included measurements for the influent and effluent flow as well as the loading of several nutrients. In general, the Marion WPCF functions well and produces a very high-quality effluent.

2.4.2.1 Marion WPCF Existing Flows

Between 2017 and 2021, the WPCF had an average daily flow of 0.515 MGD, as measured by the 'effluent' flow meter. During this time, a maximum day effluent flow of approximately 1.14 MGD was recorded on December 15, 2019.

Average flows were also reviewed for the period from 2017 to 2020. The 12-month rolling average effluent flow for a calendar year reported during this period has ranged from 0.295 MGD to 0.850 MGD. As of December 2021, the 12-month rolling average for WPCF was approximately 0.447 MGD. Effluent flow is measured continuously at the WPCF effluent flow meter, located immediately upstream of the disk filter building. The location of the existing effluent flow meter is upstream of the disk filters and UV disinfection, meaning that some flows related to filter backwashing and maintenance are recorded by the meter but not actually discharged. This results in the reported flows summarized here being somewhat higher than the actual discharged flows.

WPCF 12-month rolling average flows over the past five years are summarized in Table 2-23: Summary of WPCF Effluent Flows.

Table 2-23: Summary of WPCF Effluent Flows 2017-2021 (12-month Rolling Average)

Year	Average Annual Flow (MGD)	High Monthly Flow (MGD)	Low Monthly Flow (MGD)
2017	0.505	0.727	0.183[1]
2018	0.569	0.850	0.318
2019	0.591	0.771	0.331
2020	0.455	0.724	0.240
2021	0.447	0.591	0.295
Overall	0.515	0.850	0.240

[1] Months with lower flows due to diverting influent to the lagoons for equalization were excluded

2.4.2.2 Marion WPCF Existing Loads

Several nutrient loading parameters are monitored and recorded. Discussion of those of these parameters, biochemical oxygen demand (BOD_5) and total suspended solids (TSS), as reported in the Discharge Monitoring Reports, are discussed below. Total copper values are also presented, as total copper concentrations in the effluent are a primary concern of the WPCF and an important topic discussed in later sections of this report.

Both BOD_5 and TSS are measured weekly, using a 24-hour composite sampler. Total copper is measured monthly using a 24-hour composite sampler. Over the period between January 2017 and December 2021, reported influent BOD_5 concentration averaged 153 mg/l, ranging from 34 mg/l to 510 mg/l, and BOD influent load averaged 625 lbs/day, ranging from 167 lbs/day to 1,461 lbs/day. Over this period, the influent TSS concentration averaged 169 mg/L, ranging from 31 mg/l to 400 mg/l, and TSS influent loads averaged 702 lbs/day, ranging from 198 lbs/day to 2,018 lbs/day. Over this period, the influent total copper concentration averaged 95 μg/l, ranging from 24 μg/l to 251 μg/l.

Table 2-24: Summary of Average WPCF Influent Concentrations & Loads 2017-2021

Year	BOD_5		TSS		Copper
	mg/l	lbs/day	mg/l	lbs/day	µg/l
2017	140	585	175	741	117
2018	157	659	156	682	112
2019	134	637	162	769	92
2020	173	599	204	722	85
2021	159	640	146	591	72
Overall	153	625	169	702	95

The observed and reported BOD_5 and TSS influent loadings are consistent with moderate strength domestic wastewater.

2.4.3 *Marion WPCF Process & Support Systems*

The wastewater treatment system at Marion WPCF includes the following processes and support systems:

- Influent Pump Station
- Headworks
  - Pre-Aeration
  - Screening
  - Grit Removal
  - Odor Control
- Soda Ash Storage and Feed
- Sequencing Batch Reactors (SBR) Activated Sludge Secondary Treatment
- Disk Filtration
- Ultraviolet (UV) Disinfection
- Lagoon System
- Flow Metering
- Surface Discharge Outfall
- Buildings and Site

A process flow diagram and facility layout for the site can be found in Figure 2-16 (attached) and Figure 2-17 (attached) respectively.

A site visit to the facility was performed on August 19, 2019 to discuss needs with plant staff and tour the facility to get a better understanding of key issues and current system conditions. Due to ongoing work in the Effluent Filtration and UV Disinfection buildings, these facilities were not visually inspected during this visit; however, additional information was collected subsequently on these systems. The following is a description and condition assessment of the treatment facility based on direct observations, discussions with plant staff, and review of available record information including as-built plans and the O&M manual.

2.4.3.1 Influent Pump Station

The Front Street (Main) Pump Station, located in the Village area, functions as the WPCF influent pump station. This station pumps directly to the WPCF headworks via a 4,300 foot long force main, which is constructed of 14-inch and 12-inch DI pipe. The Front Street Pump Station is discussed in detail in Section 2.3.3.1 of this report. The influent pump station has two normal duty (a.k.a., 'low service') pumps and two high flow (a.k.a., 'high service') pumps, allowing the station to deliver wet weather flows to the WPCF, with a peak capacity of nearly 4.0 MGD (or more). Flows from the Front Street Pump Station force main are normally delivered to the WPCF headworks. Valving in the WPCF yard outside the headworks allows flow to be diverted from this force main directly to the WPCF lagoons, bypassing the headworks completely when needed.

2.4.3.2 Headworks

The headworks of the WPCF is comprised of a pre-aeration (aerated influent receiving) chamber, automatic screen with bypass and manual bar rack, influent diversion gates used to divert high flow to Lagoon 1, and vortex grit separation with a grit classifier and washer.

The headworks building has a cast-in-place concrete foundation and elevated operation floor, with architectural concrete masonry unit (CMU) block walls, and a structural steel supported steel roof deck with built up roofing. The building structure is in good condition with the exception of the interior of the aerated influent receiving chamber which has significant interior concrete surface corrosion. This part of the structure is also showing some cracks on the exterior although it does not appear to be a significant structural issue.

Headworks Building with Biofilter

Pre-Aeration

The aerated influent receiving chamber is a cast in place concrete structure, integral with the headworks building foundation. The chamber receives flow from both the Front Street Pump Station and, during low flow periods, from the lagoons via lagoon return pumps which are located in the basement of main operations building and described further in Section 2.4.3.9. The tank has an integral cast-in-place cover which is located above grade at the same top of slab elevation as the headworks building operating floor. The influent end of the tank is a single influent receiving box, 8'-6" wide and 3'-6" long with a water depth of approximately 8'-6". At the bottom of the influent receiving box are two 18" square sluice gates which feed two identical influent aeration channels. Each channel is equipped with coarse bubble stainless steel diffusers on a single distribution lateral and drop leg. Air is provided by two dedicated 10 HP Aerzen rotary lobe positive displacement blowers. The blowers are located in the blower room in the lower level of the main operations building. The channel center wall terminates approximately 9" below the tank cover. Effluent from each channel flows over a v-notch weir into the influent screen feed channel. The tank headspace is ducted to the biofilter odor control system which provides continuous fan forced air withdrawal to maintain negative pressure under the cover.

Though this tank is intended to keep solids in suspension and freshen the influent wastewater, heavy solids build up over time and these tanks generally require annual cleaning. This is a significant safety concern for plant staff as there is only one point of access, a 4'x6' aluminum hatch located at the effluent weir end of the channels. No access ladder, and no means to bypass the tank are provided. The O&M manual notes that the tank is designed to allow one channel to be isolated while the other remains in service. Doing so, however, creates significant potential for the accumulation of dangerous gasses and the possibility of overflow back into the offline tank under some flow conditions if not carefully monitored. The tank separating wall does not extend to the full height of the tank, which limits the ability to isolate the channels. Plant staff also noted that during the last cleaning, significant corrosion of the concrete surfaces both above and below the water level was observed.

Screening

Channel effluent from the aerated influent receiving chamber flows through an influent feed channel to either a mechanically cleaned rotary fine screen or to the adjacent bypass channel. The bypass channel is equipped with a coarse bar screen in the event the fine screen is out of service. The mechanical fine screen is a Lakeside "Raptor" rotary fine screen with a ¼" screen design to remove and wash large debris and rags via a spray water header. The rags and debris are conveyed by an integral inclined screw conveyor and deposited through a chute into 55-gallon drums, located at grade below the screen operating floor.

Influent Rotary Fine Screen with Screw Conveyor

The screen unit is in good condition and with routine maintenance should provide many years of service. Plant staff noted that local controls for the unit do not include an "on demand" cleaning cycle. Occasionally, during high flow periods, the screen can become blinded, and having the ability to initiate a cleaning cycle on demand would be advantageous. Staff also noted that there is no rake provided for the manual screen, making cleaning when in use somewhat frustrating.

Grit Removal

Screened wastewater flows down a channel to the grit removal system, or may be diverted to bypass the grit removal process. Normal flows proceed to a single 25" Westech vortex grit collector. The vortex grit collector has a compressed air vacuum primed grit ejector pump that pumps the grit slurry to a hydrocyclone separator and inclined screw grit washer. Grit is discharged to a haul away dumpster, or to 55-gallon drums for disposal. The grit cyclone was replaced once several years ago.

Grit Collector and Dewatering System

Screened and degritted wastewater from the headworks building normally flows by gravity through buried piping to the main SBR equipment room in the basement of the main operations building.

Staff noted that the clearance around the grit cyclone and washer are tight and made it difficult to replace the cyclone unit. However, the grit collector functions well overall. Unlike the grit system control panel, the compressor control panel and compressor unit itself are not explosion-proof. In general, plant staff noted that the equipment is in serviceable condition, but the systems show signs of age and exposure to the headworks atmosphere.

Lagoon Splitter Box

Wastewater from the grit removal process flows to a channel which is equipped with two downward opening slide gates: one is a motorized gate that directs flow to the lagoons, while the other manual gate directs flow to the SBR process. The motorized diversion gate was designed to allow automated control of incremental changes to limit peak flow to the rest of the facility. The design intent was that the diversion gate would, through SCADA, adjust downward incrementally to maintain forward flow to the plant at the design flow of 0.588 MGD based on the feedback from the downstream flow meter on the SBR influent line (located in the operations building basement). Once flows returned to normal, the gate to the lagoons would close.

Slide Gates following Grit Removal

Plant staff note that this incremental automatic diversion has never worked as the design intended (control programming was never provided for this function), and currently the diversion, when needed, is controlled by the level in the receiving SBR. When the level in the SBR receiving flow reaches the highwater level set by the operator in the SCADA system, the diversion gate opens completely, diverting all flow to Lagoon 2

until the next SBR reactor enters its fill mode. The gate then closes completely, flow goes to the other SBR, and the initial SBR proceeds with its normal timed cycle.

As of August 2020, the soda ash addition system was out of service for repairs to the feed system. When this system is out of service, the plant staff use bagged lime to provide pH adjustment and supplemental alkalinity. The lime is added manually once per day (per SBR) just downstream of the gate that allows flow to the vortex grit unit. Plant staff note that typically one to two 50 lb bags of lime are used per day (per SBR). It was also noted that during periods of heavy I&I, the pH tends to drop requiring higher amounts of lime (or soda ash, when in service).

Once the lagoon improvement project is complete, influent flow diverted to the lagoons will normally flow to Lagoon 1. However, due to ongoing work on Lagoon 1 at the time of the visit, diverted influent flow was being sent to Lagoon 2. Influent flow diverted to the lagoons is typically returned to the headworks influent pre-aeration tank, when plant flows allow, by one of two 5 HP chopper-type centrifugal lagoon return pumps (located in the basement of the main control building). The discharge is piped to also be able to be pumped directly into the SBR influent line in the main building basement.

Odor Control

The headworks building includes a separate electrical room and odor control fan room. The odor control fans draw air through a network of ducts from the headworks building and influent tank and direct it to a biofilter located adjacent to the headworks building. One of the two large fans is off-line due to damage. The odor control fans are oversized, and staff have found that the discharge of the fans must be dampened to allow access doors to be opened. Plant staff note that the biofilter media has been replaced three times to date and needs replacement again. Visually, the media is at the end of its useful life. It was further noted that the biofilter humidifier and bed spray water system is not currently functioning (the bed spray system was removed).

A separate room houses electrical equipment. The electrical equipment is generally in good condition, although it was noted that the rotary screen variable frequency drive (VFD) and various other components are aging. These older VFD's and the PLC controller will need replacement based on age and service.

2.4.3.3 Soda Ash Storage and Feed

When in service, the soda ash (sodium carbonate) feed system feeds soda ash into the SBR influent line at an injection point located in the SBR pump room in the main operations building basement. The soda ash system includes a dry chemical storage silo adjacent to the SBR reactors. A slurry mixing system is housed inside the steel silo support structure.


Soda Ash Storage Silo

At the time of the visit, the dry feed screw had failed and was out for repair. Staff noted several issues with the equipment, including a layout that made equipment access difficult and the equipment susceptible to harsh weather. The ventilation louvers on the entrance doors allowed sufficient cold air in the winter to cause a freezing problem with the makeup water feed systems. To address this issue, the staff has temporarily blocked these vents. The various pumps and mixing equipment have been replaced several times since they were installed, and the feed system requires manual intervention to adjust the feed rate when required.

As discussed in the headworks section, above, the staff occasionally adds bagged lime in the headworks. This lime addition is a manual process and does not replace the permanent use of the soda ash system.

The original buried soda ash solution feed line installed during the plant upgrade became plugged after use. The staff has constructed a temporary feed line which runs above grade from the soda ash silo enclosure to the operations building. This temporary feed line was a successful improvement to the system, and has proven more serviceable for the operations staff.

2.4.3.4 Sequencing Batch Reactor (SBR) Secondary Treatment

Effluent from the headworks building flows by gravity through a 14" DI pipe to the basement of the main operations building which houses the SBR process pumps, blowers, and other equipment. There, it passes through an in-line magnetic type flowmeter, before flowing to one (depending on which SBR is in "fill" mode) of two (99-foot x 33 foot) rectangular SBR reactors. The SBR tanks are located adjacent to and share a "common wall" with the operations building. Flow control to the reactors is provided by two mechanically actuated valves. The main building basement and SBRs are cast-in-place concrete structures. The SBRs are partially above grade, with access walkways and railings all around. Each


SBR Decanter (Fill Cycle)

SBR has a low water volume of approximately 0.374 MG at a depth of approximately 15.3 feet, and a highwater depth of approximately 20 feet. The SBRs are equipped with a worm-gear driven solids-excluding decant mechanism. Each SBR basin has a diffuser grid with 684 flexible membrane fine bubble diffusers (with blanks for an additional 72 diffuser heads), two 7.5 HP Flygt rail mounted propeller type mixers, a HACH LDO dissolved oxygen probe, and an ultrasonic level sensor.

Decant flow from the SBR goes to a single Post-SBR Equalization Tank, located adjacent to and common wall with SBR 1 and the main operations building.

Air for the SBR diffusers is provided by one of three identical 60 HP Aerzen rotary lobe positive displacement blowers located in the blower room in the main building basement (one duty and two standby, with weekly rotation of the lead blower). Each blower is equipped with a variable frequency drive (VFD) and rated at an inlet capacity of 660 acfm. The system is currently configured to run only one of these blowers at a time, based on coordination of cycles between the two SBR reactors. The system was designed with provisions to accommodate a third SBR reactor. This configuration would typically allow the second blower to be used if cycle times are altered such that aeration is required for both reactors at the same time, but the Xylem SBR controller at the Marion WPCF does not support this function. Two SBR air supply inlet valves are provided in the air discharge header to control air flow to each reactor.

Aeration Blowers

Waste activated sludge (WAS) is removed from the SBR reactors by one of two 5 HP centrifugal pumps. Waste sludge is typically discharged to Lagoon No. 1 but is currently discharged to Lagoon No. 2 while Lagoon No. 1 finalizes completion of ancillary work of the newly lined Lagoon No. 1. Waste sludge flow is measured by an in-line magnetic flow meter in the WAS pump discharge line.

Water from the Post-SBR Equalization Tank is pumped by one of two 7.5 HP centrifugal pumps to the effluent cloth filters located in the filter building. SBR ammonia, nitrate and alkalinity were once monitored by analyzers, located adjacent to where the SBR line exits the space. These units have not been in service for some years as they were difficult to maintain and prone to failure (and for the most part have been removed).

Two 5 HP double disc scum pumps are configured to discharge to the WAS sludge pump discharge line to the lagoons. Each SBR reactor was originally equipped with a floating “oil skimmer” style scum collection mechanism connected to a flexible scum collection line. Because the system designed proved ineffective, these original skimmers have since been removed, and scum is now collected by manually deploying the flexible scum line in each reactor as needed. This scum removal process is inefficient and labor intensive.

It was also noted that the HACH DO probe transmitter screens have been rendered unreadable by years of sunlight damage to the plastic screens. These are not the original DO probes, having been replaced approximately 7 years ago. The probes continue to function and can be read through the SCADA system, but replacement of the probes and display system will be needed.

The main SBR equipment is well maintained, and as such, overall is in good condition. With continued, regular maintenance, many more years of service is expected. All diffusers in the SBRs were replaced in 2018. There are however some concerns noted by the operations staff. The VFDs for the equipment are aging and, as with most electrical equipment, they are now outdated and may warrant upgrade pending further review. In addition, several of the blowers (SBR and Lagoon units) in the main blower room in the main building basement have experienced significant corrosion due to leaks from the garage space above on the main floor. The reinforced concrete garage floor/ceiling of the blower room has significant cracking throughout that has allowed water and, in the winter, salt from vehicles to leak onto several of the blowers. Operators have covered several of the blowers with tarps as a temporary protective measure until the leaks can be properly addressed. In addition, many of the pipe penetrations into the SBRs through the common wall are showing staining from leakage at the pipe penetration seals.

Sequencing Batch Reactor

Within the SBRs, the decant arms appear to be functioning well and generally are low wear parts as they do not operate at high speed. Concern was raised that the arms may not be extending fully during the decant cycle, which limits the total capacity of the plant to some degree. The Flygt rail mounted mixers were identified as somewhat difficult to maintain, and one set of rails in particular was damaged some years ago. Each rail is fabricated from two pieces causing a joint in the middle that due to vibration over time can offset and make the mixer hang up upon removal.

A significant degree of concrete spalling and cracking was observed on the SBR tank walls and walkways. This is quite widespread across the exposed portions of the tanks. Although some of the visually observable cracking is in the parged surface layer of concrete, there are locations where significant cracks are evident. In spots, rebar corrosion is evident, suggesting that some of the bars may have had less concrete cover. The corrosion of the tanks is somewhat unusual for cast in place concrete that is just over 15 years old.

Concrete Deterioration in SBR Tanks

The original operation and maintenance manuals and supporting documents provided when the system was constructed were generic in nature, and the staff have found these information gaps to be limiting. Over the years, specific operations of the SBR and control systems have therefore been found challenging at times. The existing SCADA system was upgraded, but is now more than five years old, and is Windows 7 based; the dated system has been noted as being increasing problematic. Staff also noted that the SBR control program was recently modified to allow six cycles per day per reactor; it was previously set to only allow five. This modified cycle time was achieved by altering the clock within the system such that programmed minutes are shorter than real time minutes. The alternative method of creating new programing to simply add a sixth cycle while maintaining the same cycle proportions for each phase of cycle operation was determined to be too cumbersome by the original manufacturer's system programmers. Provisions were also made for a seven cycle per day operation mode (essentially for unusually high flows). As of the time of this report compilation, the staff has not been able to operate with the compressed time clock at either the six cycles or seven cycles modes. After the completion of the effluent filter and disinfection improvements, some review and analysis will be needed to determine the impacts on plant capacity of running in these higher flow modes.

2.4.3.5 Chemical Feed and Ancillary Systems

A chemical feed and storage system room is provided on the main level of the main building adjacent to the truck bay and over the main SBR pump room. This space currently houses only the chlorine feed (hypochlorite) system for the plant water system, which include two small chemical meeting pumps feed from 55-gallon drums. The space includes three separate containment areas: future dry potassium permanganate storage and feed system and a future alum storage and feed system with space for two 1,600-gallon alum tanks. These areas assumed that future phosphorus removal would be needed at the plant, and assumed chemical precipitation using alum.

Much of this space allocated for 'future uses' is currently used as maintenance and supplies storage space. Plant staff noted a particular lack of space for operations and maintenance activities, equipment, and supplies.

Plant Water System

A plant water (PW) system is located in the basement of the operations building. This system draws water from the Post-SBR Equalization Tank and provides pressurized plant water for wash down uses around the facility, and carrier water for soda ash solution. Improvements were made to this system approximately 5 years ago, and the system is functional. Relocation of the PW intake or PW screening improvements may be needed as solids from the water affects some uses.

2.4.3.6 Main Operations Building

The main operations building houses both operations and maintenance spaces as well as administrative and related support function spaces, operating room, building HVAC systems spaces, and various offices and storage spaces. Notably, the building serves as the Department of Public Works (DPW) office space, so the number of staff normally using the building significantly exceeds the operations staff

headcount. The office space, including a small conference room, and support areas are functional and generally in good condition.

Pipe Penetration Seal Failure

Mechanical equipment that supports the SBR process are located in the basement of the main operations building with various storage and maintenance spaces above, as well as the DPW administrative offices in adjacent parts of the building. The pump room in the main building basement also houses the plant water system and other processes, and the adjacent blower room is also located on this lower level. There are some concerns noted in the lower level areas, particularly with the seals at pipe penetrations (through common walls) into the SBR tanks.

The main floor is at grade and is constructed of architectural CMU walls with steel frame supported metal deck roof with built up roofing. In general, the building is in good condition, with the exception of the floor in the truck bay and chemical storage area. The cracks and related leaks in the truck bay floor, however, are a significant issue for equipment below as previously noted. Based on the corrosion seen in the blower area below, concern for the floor reinforcing is a key factor here. As such, the long-term use of that shop/garage area for storing rolling equipment (e.g., jetter truck and portable generator trailers) should be revisited. Storage space in the main building for such equipment is limited, and a proper space for storing the jetter truck and portable generator sets will be needed.

A layout of the Main Operations Building is presented in Figure 2-18 (attached).

2.4.3.7 Disk Filter Building

The WPCF's Disk Filter Building predates the SBR system by approximately five years. The building houses a cloth media filter system, designed to allow the WPCF to meet the lower solids limits in its effluent and to support the effective function of the UV disinfection system. The existing filter system is a duplex filter system and utilizes the Aqua-Aerobics disk filters with associated equipment and controls. The building is constructed of masonry block with brick siding and is in generally good condition.

Disk Filter Building

The cloth media filters were upgraded as part of the ongoing lagoon improvements project, and were substantially complete as of March 2021. Project upgrades to the disc filter system includes the following:

- The addition of two new AquaDisk filters for both Filter Bay #1 and Filter Bay #2. Prior to this upgrade, the existing Filter Bays had two disk filters in each and now they have four.
- AquaDisk upgrades included two new NEMA 4X Control Panels, pressure transducers, and filter backwash/wasting pumps with hoses and drive chains.
- A new filter building PLC control enclosure.

Disk Filters (Cloth Media Disks)

Project upgrades to the filter building includes the following:

- Installation of new EPDM roofing and roof curbing.
- Installation of two new 12" sluice gates in the discharge channel, which control the flow to UV Channels 1 and 2.
- Improvements to HVAC systems for the electrical room.
- Removed all existing ductwork along with the intake and exhaust fans. Installed new ductwork with intake and exhaust fans.
- Installed a second hot water heater for emergency shower.
- Electrical upgrades include new disconnects for the filter backwash pumps and new power panels and transfer switch in the Electrical Room.
- New door security alarm contacts.

Side Stream Pump Station

The existing side stream pump station, located outside and adjacent to the Disk Filter Building, is an older submersible pump station. This pump station receives filter backwash flows and flows from filter tank draining during maintenance activities. This pump station also receives site sewage flows from the WPCF yard piping and flows from the odor control biofilter underdrain. The submersible pumps discharge flows to the lagoon system. This pumping facility is an important component of the overall treatment system, and the facility needs significant equipment and control improvements.

2.4.3.8 Ultraviolet Disinfection

The UV Building predates the filter building and SBR system, and was originally built to supplement the lagoon treatment. The concrete masonry building houses the Ultraviolet (UV) Disinfection treatment equipment and the automatic effluent sampler. Flow leaves the UV building and directly enters the WPCF's gravity outfall pipe. Recent building improvements include a new hot water heater with associated copper piping, exhaust fans, intake louvers, security alarm devices and associated electrical gear (transformers, disconnects and power panels).

UV Building Exterior

The building structure is an older masonry block building and shows significant signs of age and deterioration. The

roof has a history of leaks, and the roof and skylight systems need replacement. Building envelope improvements are needed.

The disinfection systems are being upgraded as part of the ongoing lagoon improvements project, and these upgrades were substantially complete as of March 2021. Project UV equipment upgrades include concrete modifications to UV Channel #2 to accommodate the new UV equipment, the addition of TrojanUV 3000 Plus Ultraviolet Disinfection Treatment equipment to channel #2, upgrades to existing UV equipment in Channel #1, and a new UV System Control Center. Under normal operating conditions the Town will operate one channel at a time. Flow to each channel is controlled by two slide gates inside of the Filter Building.

2.4.3.9 Lagoon System

The WPCF has three lagoons, which are original to the facility and were converted for use as influent equalization and for sludge management, when the plant was upgraded in 2005. In 2020, Marion commenced work relating to the Lagoon Optimization Plan, the details of which were described in Section 1.3. As part of this work, Marion has started to dredge Lagoon No. 1, so that it can then be lined and used as the primary lagoon for influent equalization and sludge management, thereby minimizing the use of the other lagoons. As part of the liner system being installed under the Lagoon No. 1 improvements, a forebay is being added to this lagoon to help capture heavier solids as they enter the lagoon.

Lagoon No. 1

In 2020, accumulated solids from Lagoon No. 1 were dewatered on site and hauled away for off-site disposal. As of the end of December 2020, over 990 dry tons of waste solids were hauled away and disposed of from the lagoon. The Town removed the remaining solids from the lagoon in 2021 and completed the process of lining the lagoon as of January 2022. Lagoon No. 1 will be placed back in service as of the end of December 2022.

Lagoon No.1 is the northern-most lagoon and has an approximate area of 5 acres. Lagoon No. 2 is the eastern-most lagoon and is also 5 acres in area. Lagoon No. 3 is the southern-most lagoon and is approximately 10 acres in area. The lagoons are constructed with sloped earthen sides, and each has a maximum depth of approximately 8 feet from bottom to top of surrounding berm. The system of piping and gates that allow discharge to and withdrawal from the lagoons is also being upgraded as part of the current lagoon improvements project. The lagoon project includes the following improvements:

- The installation of a Lagoon Transfer Pumping Station. This pump station will transfer water from Lagoon #2 and #3, and pump the water into the existing Diversion Structure, and from there it will be discharged into Lagoon #1. The 5’ diameter Pump Station consists of one 5HP submersible pump and there is a separate flow meter vault on the discharge side of the Pump Station that has a 4” diameter flow meter.

- Installation of a new 12" flow meter and vault for the flow diverted to the Lagoons after the SBR process.

- Installation of a new 14" flow meter and vault for the WPCF influent flow heading out to the Lagoons. This flow is diverted to the Lagoon prior to the SBRs.

Each lagoon also has a system of coarse bubble diffuser aerators fed from floating air lines. The blowers serving the lagoon aeration system are located in the lower level of the operations building. The aeration systems for Lagoon No. 2 and No. 3 will need significant repairs in the future. The Town will be preparing a High Flow Management Plan, as required by the compliance orders for the WPCF. This plan will help determine the service level expected for Lagoon No. 2 and No. 3. At that time, the needs for improvements to these lagoons will need to be reviewed.


Influent Magnetic Flow Meter

2.4.3.10 Flow Metering

A system of flow meters measures flows at the WPCF including influent and effluent flows, as well as flows from various side streams. Each of these flow meters are currently magnetic type flow meters. As part of the 2004 WPCF upgrades, influent flows have been measured in the main operations building, downstream of the headworks and before flow is sent to the SBRs. Separate metering is provided for sludge wasted from the SBR tanks to the lagoons, for lagoon return flows to the WPCF, for the wastewater sidestream pump station, and for plant water withdrawn from the equalization tank. Effluent flows are currently measured just upstream of the disk filter system. This results in the over-reporting of effluent flows – that is the WPCF actually discharges less flow than is reported by the effluent flow meter (and is recorded on the Discharge Monitoring Reports). The staff has expressed a desire for a new effluent flow meter to be located downstream of the filter system, to more accurately report the actual effluent volumes.

As part of the ongoing WPCF lagoon improvements project, new flow meters are being installed to measure flows to and from the lagoons, as described in the prior section. These meters are located in vaults in WPCF yard piping and will allow more accurate recording of lagoon flows. This work is a requirement of the compliance orders mandating lagoon improvements.

2.4.3.11 Surface Discharge Outfall

The WPCF discharges to the "Unnamed Brook to Aucoot Cove" (MA95-80), occasionally called "Effluent Brook," and sometimes referred to as "Giffords Brook." The current outfall pipe extends a distance of approximately 4,000 feet, from the disinfection building to the southeast side of Route 6, and discharges to the brook behind #25 Abel's Way. The receiving water, Effluent Brook is a tributary to Aucoot Cove. The outfall is constructed of a combination of reinforced concrete pipe (RCP) and high density polyethylene (HDPE) pipe, and has a diameter of 18-inches. As a gravity pipeline, the outfall has access

manholes along its length. The alignment and location of the outfall pipeline can be seen on the WPCF Outfall Sewer map on Figure 2-12 (attached). Part of the pipe was upgraded when the SBR plant was added in the early 2000's. Based on information from that upgrade, the outfall is sized for the peak discharge flow rate of 1.8 MGD. There is concern for the condition of the older outfall sections, as some of the manholes show signs of deterioration

2.4.3.12 Solids Processing

The Marion WPCF has no conventional solids processing on site. All waste solids are disposed of to the WPCF lagoon system. No other sludge storage system is available at the WPCF, and as such the lagoons present the only option at this time. Until 2020, the Town of Marion had not hauled solids out of the WPCF or lagoon system at any recorded time.

2.4.3.13 Buildings and Site

The WPCF and adjacent lagoons are located on a large Town-owned site. Adjacent parts of the site are used for Town solid waste transfer station, former landfill, and Town composting operations. The site allows for adequate space for the current facility. There appears to be space for some limited future needed improvements, though there are some constraints on the area available for WPCF uses. Functional use of the surrounding areas, and the possible use of parts of the site for future DPW facility expansion, suggest that space on the site is actually quite limited. A significant open space buffer exists around the site, including the landfill and lagoons. The nearest residential home or business structure is over 1,000 feet from the process tankage or lagoons.

Limited parking is available at the site for staff, and additional area is needed when construction or other major maintenance activities are ongoing on the site. Considering that the main building also serves as the DPW office, public and visitor parking is extremely limited. The placement of utility/light poles in, and the travel paths for plant operations truck traffic through the parking areas, exacerbates the parking lot issues. Access to the treatment site is controlled by a fence enclosure and gate, and security is not seen as a significant concern.

Enclosed vehicle storage is lacking on the site. The one enclosed garage area inside the operations building has issues with the floor and salt leakage into the blower room below, and alternate vehicle and rolling equipment storage should be considered. This area was not designed for larger truck storage, but even smaller rolling equipment causes continuing issues in this area. Dedicated space for storage of all the various rolling equipment (trucks, jetter truck, trailers, portable generator sets, etc.) at the plant is a significant deficiency for the WPCF.

The site lacks a well-designed space for dumping and/or drying of sewer and drain cleaning solids (e.g., vactor solids). These have historically been dumped directly into Lagoon No. 1, and while an improved system is being included for Lagoon No. 1, alternatives for this disposal of trucked solids is needed at the site.

2.5 Regulatory Compliance

Currently, Marion is entered into three regulatory agreements related to its WPCF which place limitations and requirements on its operation, in addition to those required of its NPDES Permit. The requirements of these orders are extensive, and a brief summary is included herein for discussion.

2007 Order – Copper

The first of these regulatory orders, Docket No. 08-002, Findings of Violation and Order for Compliance (2007 Order) became effective in October 2007. The 2007 order was issued in response to the violations of the Town's 2006 NPDES Permit. The 2007 Order found that Marion had routinely discharged wastewater containing total copper in concentrations greater than the effluent limitations contained in the NPDES Permit. The 2007 Order established the following interim total copper effluent limits, which are still in effect as of the writing of this report:

- Average Monthly Concentration: 20 µg/l
- Maximum Day: Report (µg/l)
- Measurement Frequency: once per month
- Sample Type: 24-hour composite

The 2007 Order required that should the interim copper limit be violated under certain conditions, a Copper Optimization Engineering Report must then be written. This report was written in 2011, as described in Section 1.3. Additionally, this 2007 Order requires that annual progress reports be submitted to EPA and MassDEP, which continue to be prepared annually as of the writing of this report.

2017 NPDES Permit and AOC

In 2017, the Town's NPDES permit was renewed. However, the Town contested numerous provisions of the April 2017 NPDES permit (including provisions that required the lagoons to be closed or lined), and the Town resolved the dispute by entering into an Administrative Order on Consent (AOC) with the EPA (Docket No. CWA-AO-R01-FY17-14) in October 2017. The AOC was in addition to (and did not replace) the 2007 Order. The AOC also imposed requirements related to the lagoons including, but not limited to, the following provisions:

- Removal of all sludge from and lining of Lagoon No. 1
- Limitations of sludge diversion to Lagoons Nos. 2 and 3
- Quarterly nitrogen testing of each lagoon
- Development and adherence to a Lagoon Optimization Plan

The Lagoon Optimization Plan was completed in 2018 as discussed in Section 1.3.13. Further discussion of the recommendations of the Lagoon Optimization Plan and the status of improvements can be found in Section 2.4.3.9. Further details are available in the semi-annual reports required to be submitted by the Town as part of the regulatory compliance orders.

2017 AOC - Phosphorus

The AOC prescribed interim total phosphorus limits for as long as Marion participates in the Regionalization Study with the Wareham WWTP (which is discussed in Section 2.7). In the event that Marion is no longer considering regionalization, the total phosphorus limits of the 2017 NPDES Permit will govern - unless the Town has moved the outfall. The interim total phosphorus limits, are as follows for total phosphorus, and apply seasonally from April 1st – October 31st:

- Average Monthly Concentration: Report µg/l and lbs/day
- Maximum Day: Report (µg/l)
- Measurement Frequency: once per week
- Sample Type: 24-hour composite

Nitrogen Requirements
The regulatory orders (including requirements of the ACO) developed temporary limits for flow and total nitrogen during certain construction periods associated with the Lagoon Optimization Plan recommendations:

- Total Nitrogen: 8 mg/l and 39 lbs/day (effective April 1st – October 31st)[4]
- Flow: 0.64 MGD (based on most recent EPA letter)
- Measurement Frequency: once per week
- Sample Type: 24 hours composite

AOC and ACO Status Update
In 2019, Marion entered into a Settlement Agreement by Administrative Consent Order (ACO) (OADR Docket No. 2017-007) with the MassDEP additionally resolving the dispute of the 2017 NDPES Permit. Requirements of the ACO are the same as the AOC for phosphorus and nitrogen interim and temporary limits. Similar to the AOC, the ACO additionally requires adherence to the recommendations of the 2018 Lagoon Optimization Plan. Required only in the ACO, the Town must also submit several iterations of a High Flow Management Plan which describes the operation of the WPCF and lagoons during times of high flow and subsequent biannual High Flow Management Plan (HFMP) progress reports, following the completion of the recommendations of the Lagoon Optimization Plan. Due to delays in construction, the Town requested in December 2020 that the requirements related to the HFMP be postponed. In correspondence dated March 30, 2021, EPA agreed to extend the time of completion of the lagoon lining project to January 31, 2022. As of December 2021, the lagoon No. 1 lining work is nearing completion.

Full copies of the 2007 Order, 2017 AOC, and 2019 ACO can be found in Appendix D.

2.6 Existing Wastewater Budget and User Rates

The Town of Marion's Wastewater Department is organized as a division of the Department of Public Works. The financial aspects of the Wastewater Department are managed under a Sewer Enterprise Fund, which ensures that wastewater revenues are used to pay for wastewater expenses locally. The most recent annual budgets for the wastewater department are summarized in Table 2-25.

[4] Per the EPA correspondence dated March 30, 2021, the interim nitrogen limit ends with the end of the season for the lower nitrogen limit (ending October 2021). The revised flow limit extends through the lagoon completion date (end of January 2022).

Table 2-25: Summary of Wastewater Department Budget

Budget Category [1]	FY20 Amount	FY21 Amount	FY22 Amount
Personnel (salary, OT, training, etc.)	$375,837	$432,916	$456,765
Utilities (power, heating fuel, telephone)	$206,760	$206,760	$206,760
Vehicle Expenses (fuel, repairs, etc.)	$16,500	$16,500	$16,500
Contracts & Engineering	$75,500	$105,000	$105,000
Testing	$46,000	$46,000	$46,000
Chemicals	$44,000	$44,000	$44,000
Supplies & Miscellaneous Expenses	$47,100	$47,100	$47,100
Repairs	$103,500	$93,500	$93,500
Annual I&I Program	$190,000	$0 [2]	$0 [2]
CMOM	$50,000	$75,000	$75,000
Debt Service	$1,417,102	$1,557,603	$1,791,545
Reserve Fund	$60,000	$60,000	$60,000
Indirect Costs (benefits, shared, legal, etc.)	$482,529	$454,695	$450,597
Total Budget	$3,114,828	$3,139,074	$3,392,767

Notes: [1] These budget categories are summarized from the line items in the actual budget. More detail is available from review of the budgets themselves.
[2] In FY21 and FY22, the budget of $190,000 for the annual I&I program was maintained but was funded through a separate Town Meeting capital article, rather than through the wastewater annual budget.

The Marion wastewater budget has a few notable aspects that are worthy of observation:

- Total costs for debt service (including principal, interest, and finance costs) accounts for over half of the total wastewater costs in the FY22 budget.
- The debt service costs include continuing payments for the WPCF upgrades and related sewer projects completed in the early 2000's, which were financed over 30 years, resulting in debt service continuing into the mid-2030s for these costs. A portion of the sewer extension debt service costs are offset by continuing revenue from sewer betterments.
- Notably missing from the Town's wastewater budget is a line for sludge disposal, as this has been historically handled using the on-site lagoons. In typical communities with wastewater treatment budgets, sludge disposal costs represent one of the highest recurring annual costs (excluding debt service).
- The budget for indirect costs includes a significant budget for legal costs, which is significantly attributable to the ongoing regulatory compliance orders from EPA and DEP.
- The budget for indirect costs includes a significant amount for shared employee expenses – this typically includes time spent by non-wastewater department staff on wastewater issues.
- Town properties and buildings are not currently 'billed' for sewer usage, but the Town addresses the cost of sewer service for public buildings through an internal cost transfer.

The primary source of annual revenue for the Wastewater Department in Marion is sewer user charges. Connection fees and other related fee charges supplement the revenue. As the WPCF does not accept septage, no significant additional treatment revenues are received. Sewer customers are billed quarterly. Billings include a quarterly base charge, which varies by water meter size (e.g., $133.94 for a 5/8-inch x 3/4-inch meter, $200.92 for a 3/4-inch meter), plus a usage charge based on water meter readings for the water that passes through the customer's meter. The current (2022) sewer use charges are shown in Table 2-26.

Table 2-26: 2022 Sewer User Rates

Rate	Billing Units	Tier Range
$73.75	per 1,000 cubic feet (cf)	≤1,000 cf
$208.51	per 1,000 cubic feet (cf)	1,001 – 2,000 cf
$330.13	per 1,000 cubic feet (cf)	2,001 – 3,000 cf
$352.56	per 1,000 cubic feet (cf)	≥3001 cf

Based on recent available information, a typical sewer user in Marion uses an average of 138 gallons per day of water, which equates to approx. 6,740 cubic feet per year (or 1,686 cubic feet per quarter). The typical bill for such a customer based on the above rates would be:

- Approximately $350 per quarter, or nearly $1,400 per year, for a customer with a 5/8-inch x 3/4-inch meter.
- Approximately $417 per quarter, or nearly $1,670 per year, for a customer with a 3/4-inch meter.

These sewer user costs are high compared to typical costs in other Massachusetts communities. As an example, a similar sewer user in Mattapoisett using the same 6,740 cubic feet described above would be billed approximately $725 per year. It is important to note that sewer costs vary greatly from community to community for various reasons. Notably, many communities pay some of the debt service related to system capital expenses through the general fund (i.e., property tax rates) or from other sources, thus effectively reducing the sewer user rates.

2.7 Regional Wastewater Considerations

The coastal region surrounding Marion offers two adjacent communities with existing wastewater systems – Mattapoisett to the west, and Wareham to the east. The inland areas north of Marion are rural, primarily undeveloped open space, with no significant wastewater disposal system. This limits any regional options available to Marion to the two coastal neighbors.

The Mattapoisett sewer system serves its Town Center and limited coastal areas. Mattapoisett sends all wastewater collected in its system to the Fairhaven plant for treatment. The Fairhaven wastewater treatment plant is located approximately 6 miles from the Marion town line, and is permitted to discharge 5.0 MGD to the Acushnet River. Treatment requirements for the Fairhaven plant include effluent limits of 30 mg/l for BOD, 30 mg/l for TSS, a seasonal Total Nitrogen load limit (based on 3.0 mg/l total N), and no phosphorus limit.

The *2017 Aucoot Cove Sewer Evaluation* reviewed options for extending sewer to areas around Aucoot Cove in both Marion and Mattapoisett. It would appear options exist for connecting some or all of these areas to either the Mattapoisett system or the Marion system. There are currently no active discussions

with the Town of Mattapoisett regarding possible regional connections, though Marion may explore renewing these discussions.

The Wareham sewer system serves various coastal areas of its town. As a small regional plant, the Wareham facility also provides wastewater treatment for parts of Bourne. The Wareham wastewater treatment plant is located approximately 4 miles from the Marion town line and is permitted to discharge 1.56 MGD to the Agawam River. Treatment requirements for the Wareham plant include effluent limits of 10 mg/l for BOD, 10 mg/l for TSS, and seasonal nutrient limits similar to Marion's permit (4.0 mg/l Total Nitrogen and 0.2 mg/l Total Phosphorus).

Several years ago, a study was initiated by the Buzzards Bay Coalition (BBC) to evaluate regional treatment options surrounding the Wareham facility. These studies have focused on options to expand the Wareham treatment facility and divert effluent through a long outfall to the Cape Cod Canal in the vicinity of the Massachusetts Maritime Academy. Marion has been cooperating with these ongoing studies, including review of economics associated with the plan. Marion is currently awaiting information from BBC and/or Wareham related to regional system costs and feasibility.

3.0 FUTURE CONDITIONS ASSESSMENT

Information in this report section will document the projections and assumptions for future conditions in Marion used in the development of the needs analysis. The planning period for this CWMP is 20 years, so projections are forward looking to accommodate potential changes until 2041.

3.1 Study Area Growth Projections and Redevelopment

3.1.1 *Demographic Projections*

The University of Massachusetts (UMass) Donahue Institute (UMDI), in collaboration with the Massachusetts Department of Transportation (MassDOT), led an effort to produce population projections for all Massachusetts municipalities. The projections were updated most recently in 2018. UMDI has projected that the Town of Marion will experience a significant population decrease of approximately 27% by 2040, an acceleration of the 4% decrease seen between 2000 and 2010 census counts. UMDI methodology is primarily backward-looking, extrapolating trends in deaths, migration, and births in Marion from prior years' census information.

The actual population in Marion in 2019 was 5,132 as reported by the American Community Survey (ACS). This is a minimal increase (less than 0.2 percent change) since 2000 but reflects an increase of approximately five percent since 2010. This misalignment of UMDI projections and actual population change between 2000 and 2010 indicates that the UMDI projections may be overly reliant on past data and/or trends that have changed considerably over time.

The regional planning entity, SRPEDD, also conducted a population projection analysis which included the Town of Marion. This data is included in SRPEDD's 2014 Fact Book for the region. SRPEDD projected only as far as 2030 but considered local and regional specific factors that UMDI did not. It was noted in Marion's 2015 Housing Production Plan (HPP) that any increase in available housing, and particularly less expensive housing, was likely to drive population growth. SRPEDD's expected population for Marion in 2030 is 5,552 (an eight percent increase from the 2019 actual population of 5,132). SRPEDD's population growth projection for Marion is similar to that for neighboring Wareham.

The results of both organizations' analyses for population change in Marion are presented in Table 3-1 and Figure 3-1.

Table 3-1: Population Projections for Marion

Projection Source	Actual (Census)		Projected		
	2000	2010	2020	2030	2040
UMDI	5,123	4,907	4,614	4,256	3,762
SRPEDD	5,123	4,907	5,502	5,552	-

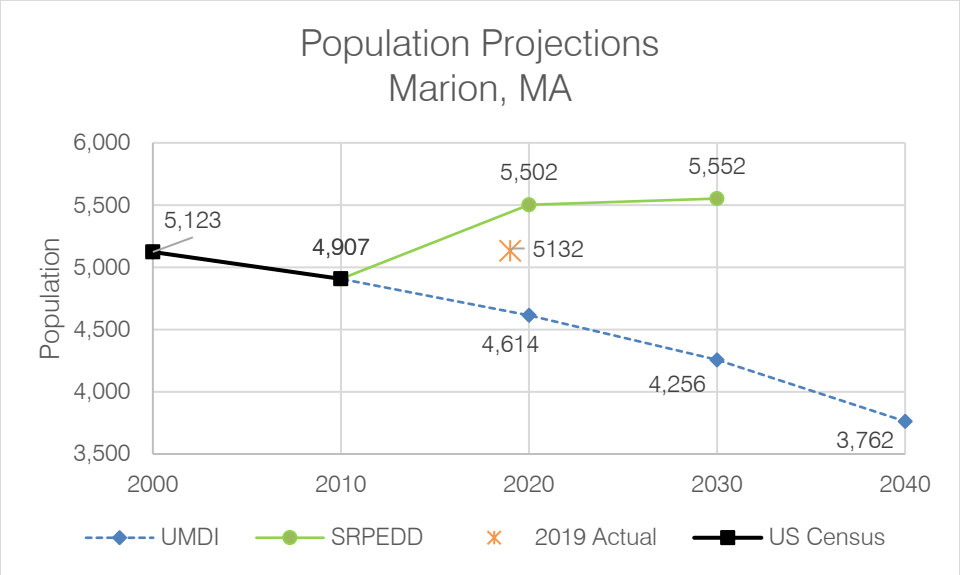

Figure 3-1: Population Projections for Marion

The two population projections produced significantly different results. UMDI projected a noteworthy population decrease from 2019 to 2030, while SRPEDD projected a population increase in the same time frame. A comparison of 2040 projections was not possible since SRPEDD did not project beyond 2030. Given the major differences between the two projection models, it is difficult to predict how Marion's population may change by 2040. However, the SRPEDD population growth projection appears to be closer to actual growth, as it has reflected positive (though relatively flat) population growth for Marion.

For the purposes of projecting changes in the sewered area as part of this report, we will consider the relatively flat population projection from SRPEDD as projected between 2020 and 2030. SRPEDD projections show an increase in Marion population of approximately 1% over this ten-year period. As this CWMP seeks to plan for the coming 20 years, we will consider a nominal population increase of 2% over the planning period when developing wastewater flow projections for the population served.

3.1.2 *Development Projections*

In 2009 the Buzzards Bay National Estuary Program (BBNEP) performed a build-out analysis for development in Marion. This build-out analysis of all parcels was based on the zoning which existed in 2009, as well as several other development limitations including environmental protections and frontage requirements. In April 2020, SRPEDD performed a build-out analysis for the residential zoning districts only. Their methodology, which considered only the lot size and no other development-limiting factors specific to individual lots, resulted in a high estimate, which is further refined in the sections below. As can be seen in Table 3-2, SRPEDD's conservative estimate of developable units in residential districts is considerably lower than BBNEP's estimate from 2009. This may be, in part, due to changes that occurred between the BBNEP work in 2009 and the time of the 2020 SRPEDD analysis. For both BBNEP and SRPEDD, subdivision of available lots was considered to calculate an estimation of the number of units which could be developed.

Table 3-2: BBNEP and SRPEDD Build-Out Results by Zoning District

District	2009 BBNEP		2020 SRPEDD
	Total Potential Units	Projected Growth	Estimated Developable Units
Residence A	326	71	17
Residence B	632	66	23
Residence C	1,211	236	37
Residence D	1,499	728	513
Residence E	34	8	-
General Business	409	162	-
Marine Business	70	40	-
Limited Business	110	59	-
Limited Industrial	163	150	-
Tabor	68[1]	41[1]	-
Town-Owned, Unprotected Open Space	1[1]	1[1]	-
Total	**4,523**	**1,150**	**590 (Residential Only)**

[1]During the presentations of the BBNEP build-out information, public comments were made regarding the assumptions of future use for the Town owned, unprotected open space parcels, and the land owned by Tabor Academy. Build-out calculations are based on the existing zoning and what that zoning would allow in growth over time. For the purposes of the build-out report, no assumptions were made regarding the future intentions of landowners. The total reflects the projected residential growth plus the Tabor projection.

Both build-out analyses are projections based primarily on land use analysis and do not consider all other future factors which can limit or change development patterns. Despite this limitation in the analysis, a build-out is a helpful tool in assessing the potential future growth of a community. This, along with population projections, can provide insight into future growth and development within the community. When we consider that the Town of Marion has issued 11 single-family home building permits on average each year since 2000, along with the fact that the population has seen a 4.6% increase from 2010 to 2019, and the current expectation of only modest population growth, the future growth and development numbers in the Town can be better understood. Since changes in development and growth impact infrastructure, it is important to quantify this on some basis to protect, and thereby prolong, the useful life of future investments.

One notable factor in these development projections is the occurrence of larger development projects in Marion. An example of this is the Marion Village Estates project, a large residential development that was completed c. 2018. This development, and others of its kind, have the ability to significantly change Marion's sewered population in a relatively short time period. Further information on anticipated developments in Marion is included later in the discussion of future flows and loads.

3.1.3 *Housing Production Plan (HPP) Goals*

The Town of Marion adopted a Housing Production Plan (HPP) in 2015. The purpose of that plan was to create a proactive strategy to meet the housing needs of the community and, in particular, to plan for the development of affordable housing. The HPP provides a variety of suggested strategies to achieve that goal; five of those strategies, referenced below, have implications related to the amount of housing that can be produced in the Town:

- Strategy 3: create a Neighborhood Overlay District to allow for mixed-use village development
- Strategy 4: zone additional areas of Town, that are serviced by both water and sewer, as Residence E, allowing for multifamily housing in a compact development pattern
- Strategy 5: provide a density bonus for senior housing development
- Strategy 7: loosen the criteria in the Open Space Development District to encourage the development of starter homes and 55 and over housing
- Strategy 9: look into affordable housing options on municipal and donated land

Since 2019, the Town has adopted several of these strategies, including the development of a Residence E zoning district. The Marconi Village Apartments are the first to be built in the Residence E zoning district. While the HPP advocated for increased housing development in Marion, it targeted areas for development to those that were already sewered. Figure 3-2 (attached), as compiled by SRPEDD in 2015, shows the areas of Marion which were targeted for housing development.

3.1.4 *Affordable Housing and Other Initiatives*

As of December 2020, 8% of Marion's housing stock was considered affordable, per the Massachusetts Department of Housing and Community Development (DHCD). DHCD housing data shows that the Town has a total of 2,014 housing units, of which 162 are listed on the Subsidized Housing Inventory (SHI). Increased affordable housing was one of the main goals derived in the 2015 HPP. Since the 2015 HPP, an additional 36 housing units, 9 of which are affordable, were built as part of the Town's first 40B development, the Sippican Woods Single Family Homes development.

Because the Town has not yet met the Commonwealth's target goal that 10% of its housing stock be affordable, the Town continues to be subject to applications for Comprehensive or 40B permits. One such known project, Heron Cove Estates located at 78 Wareham Road, proposes to build 120 units of housing, 24 (20% of the proposed units) of which are proposed as affordable. This project is still in the planning and development permitting stage and has undergone a review of sewer infrastructure needs by the Town.

3.1.5 *Current Potential Development Information from Planning Department*

Based on the 2020 SRPEDD build-out analysis of residential zoning, which was discussed in Section 3.1.2, a conservative estimation of 590 residential units are estimated to be developable in Marion. However, several factors, such as additional zoning limitations due to wetland cover and lot frontage requirements were not considered; nor was the likelihood of new developments to connect to sewer. Therefore, the true number of developable, residential units is likely significantly lower (this assumption has been confirmed by the Marion Planning Department).

In addition to the 40B development, Heron Cove Estates, discussed in Section 3.1.4, which has been advanced but has not yet been approved by the Planning Board, there is one subdivision which has been approved but not yet built for one additional home on Cove Street. The Town has also recently

become aware of a potential development adjacent to Wareham Road and the Weweantic River which may include up to 50 single family units.

The Town has indicated other areas in Town where future, significant development is possible, though the likelihood is yet to be determined. These areas include a 14-acre parcel at 340 Converse Road, which is currently zoned as Residence D and an 11-acre parcel at 391 Front Street which is zoned Residence C. There is also a 16-acre parcel at 630 Mill Street at which the current DPW building is located. The Town is in the process of planning new DPW facilities, and as such it is possible that this facility may be moved to another location. There has been some preliminary thought to reusing this site for purposes as varied as senior housing to vehicle parking.

The Town has also highlighted the "Gateway," the area at the Front Street (Route 105) and Route 6 intersection, as a priority area for economic development. The Gateway, which does not have designated boundaries, is approximately 200 acres with some parcels that could be developed in the future into village-style, mixed use neighborhoods. However, none of the above-mentioned projects have begun a permitting process, and some may require zoning changes. As such, these projects may take years to develop, or may never come to fruition.

3.2 Wastewater Flows and Waste Load Projections

In order to meet its wastewater needs, Marion must understand how much wastewater will be generated in the future. This information is critical to evaluate treatment system alternatives. Additionally, if sources of wastewater change in the future, so too will the loading to the WPCF. Therefore, in order to maintain treatment levels that meet NPDES permit requirements, future loading characteristics must also be projected. The following sections detail the potential wastewater flows and loads for the Town system over the planning period.

3.2.1 *Future Wastewater Flows*

Future wastewater flows for the Town of Marion will be comprised of existing system flows and projected future flows. Existing measured flows at the WPCF are known and include sanitary flows from users and extraneous flows from infiltration and inflow (I&I) sources. Sanitary flows are contributed by all connected properties, including residences and larger users. The current sanitary flow contributions from Tabor Academy, the Town's notable institutional user, can be estimated. Based on sewer billing records (examined for the past 3 years), Tabor contributes no more than 17,000 GPD - less than 3% of the WPCF's total flow. This number excludes the lower 2020 seasonal flows that reflect lower water and sewer use by Tabor during the impacts of the COVID-19 pandemic. Extraneous flow contributions from infiltration and inflow vary significantly based on weather conditions and seasonal groundwater levels. These flow fractions are therefore more difficult to estimate consistently. In general, inflow and infiltration sources are believed to comprise approximately 40% of all flow received at the WPCF, as was reported in previous I&I reports and discussed in Section 1.3.

As discussed in Section 2.4.2 of this report, the historic average daily flows (ADF) to the WPCF typically trend below 0.600 MGD, based on a 12-month rolling average (as calculated for permit reporting purposes). Between 2017 and 2021, the lowest monthly average ADF was 0.24 MGD and highest was 0.85 MGD. The annual averages for ADF based on plant effluent flows has been approximately 0.515 MGD over the five-year period (2017 through 2021). While future flows cannot be predicted with precision, it is appropriate to use historic data to project base flows to be treated at the WPCF.

It is notable that the use of effluent flows as measured at the WPCF is understood to reflect higher flows than have actually been discharged by the WPCF. This is due to the location of the effluent flow meter ahead of the disk filter process, which results in some flows from backwash, cleaning and related operations being measured by the effluent flow meter but not discharged (such flows are instead returned to the lagoons for later treatment). As a check on this data, the effluent flows, as reported between 2017 and 2021, were compared to the flows recorded being pumped from the collection system (via the Front Street Pump Station) to the WPCF. This comparison of historic flows is reflected in Table 3-3.

Table 3-3: Comparison of WPCF Effluent Flows to Collection System Flows

Calendar Year	Effluent Flow (12 mo. Avg.)	Collection System Flow (Avg.)	Variation of Collection System Flow to Effluent
2017	0.507 MGD	0.511 MGD	~1% higher
2018	0.571 MGD	0.561 MGD	~2% lower
2019	0.592 MGD	0.537 MGD	~9% lower
2020	0.456 MGD	0.431 MGD	~5% lower
2021	0.447 MGD	0.459 MGD	~3% higher
4-year Average	**0.515 MGD**	**0.500 MGD**	~3% lower

It is notable that the larger variations in 2019 and 2021 shown in the table above are consistent with the efforts in those years to draw the lagoon levels down prior to the lagoon improvement project at the WPCF. The comparison of the long-term averages presented above also supports the conclusion that the effluent flow meter reflects flows that are higher than the actual flows discharged by the WPCF. As such, the use of the 0.515 MGD average daily flows to represent annual flows is expected to be somewhat conservative.

Future flow projections should include additional flow allowances for changes within the existing sewer system and for the increase in the number of sewered properties due to new development and planned sewer extensions. Table 3-4 provides an assessment of current flows received at the WPCF and projection of expected future flows. The future flows, as presented in this table, include provisions for infill development and growth within the current sewered area, added flow from currently planned (anticipated) developments, and flows from sewer needs areas that may be recommended for sewer extensions in the CWMP. Each of these projected flow components is discussed further, later in this section of the CWMP.

Table 3-4: Average Daily Design Flow Projection to WPCF

Flow Description	Average (MGD)
Existing Flows[1]	0.515
Infill & Growth in Sewered Areas	0.050
Unsewered System Needs Areas (Recommended Areas)[2]	0.091
Planned/Anticipated Development	0.030
Projected Future Flow to WPCF - TOTAL	**0.686**

[1]Existing Flow includes those contributed by Tabor Academy and existing inflow/infiltration.
[2]Recommended Areas are discussed in further detail in Section 5

There is significant variability in predicting future wastewater flows. A further discussion of some of these flow estimates follows. For illustration purposes, a range of expected (high, middle and low estimates) future flows is presented in Table 3-5.

Table 3-5: Future Flow Projection Ranges to WPCF

Flow Description	Low Flows (MGD)	Mid-Range Flows (MGD)	High Flows (MGD)
Unsewered System Needs Areas [1]	0.057	0.116	0.132
Infill & Growth in Sewered Areas [2]	0	0.025	0.050
Planned/Anticipated Development [3]	0.014	0.022	0.030
Inflow/ Infiltration (Removal) [4]	-0.070	-0.035	0
Future Flow Increases - TOTAL	**0.001**	**0.128**	**0.212**

[1] Needs area flows include only High Priority areas in the low estimate, High and Medium Priority areas in the middle range estimate, and all areas in the high estimate.
[2] The high estimate includes all projected infill and growth, while the middle estimate includes half this amount, and the low estimate assumes no growth.
[3] The high estimate includes all identified development, while the low estimate assumes only the currently proposed Heron Cove Estates development flows. The middle number assumes the mid-point between these numbers.
[4] These are estimates of inflow/infiltration removal on an average flow basis, and thus are negative numbers. The high flow assumes no net removal, while the low flow assumes a significant net removal, estimated by the current I&I improvements design staff. The middle number assumes the mid-point between these numbers.

Detailed information on the calculation bases for these future flows is included in Appendix E, and a brief description for each future flow category follows.

Eleven currently unsewered areas are justified as Unsewered System Needs in Section 4.1.2; for this future flow assessment, it is assumed that all unsewered system needs areas will eventually connect to the sewer. Refer to the Recommended Plan in Section 6 of this CWMP for more discussion related to the unsewered system needs areas.

Infill & Growth
Future flows due to infill has been calculated based on a combination expected population growth and new connections within existing sewered areas. New connections in areas with existing sewer service are described as infill and are presented in Table 3-6. It is assumed at all infill lots will eventually connect to the sewer.

Table 3-6: Infill Future Flows

Sewershed Areas		# Infill Units [2]	Infill Future Flow [1] (GPD)
Gravity	Creek Road PS area	32	5,280
	Front Street PS area	30	4,950
Low Pressure	LP1	20	3,300
	LP2	31	5,115
	LP3	7	1,155
	LP4	39	6,435
	LP5	47	7,755
	LP6	38	6,270
TOTAL		244	40,260

[1] Calculated based on 165 GPD future flow (ADF) per infill unit.
[2] Infill includes parcels fronting municipal and private sewers.

Additional provisions for a population growth of 2% of existing sewer users has been assumed based on the population projection discussion. Conservatively, this may be applied to four-year average (existing) flows to the WPCF, to provide a rough approximation of 10,000 GPD of flow related to future population increases within the sewer area. Considered together, the total future flows due to infill and growth are conservatively carried as approximately 50,000 GPD.

Planned/Anticipated Development

Known development future flows identified for this study include the Heron Cove Estates development and the proposed adjacent development on Wareham Road along the Weweantic River (a.k.a., the Zucker development), which are discussed in Section 3.1. An allowance for future development of up to 50 residential units is also included for the current Lockheed-Martin site. Future average daily flow projections carried for these areas are as follows.

- Heron Cove Estates Development .....14,000 GPD
- Wareham Road/Weweantic River Development .....8,000 GPD
- Lockheed-Martin Redevelopment .....8,000 GPD

It is noted that there are no known growth plans for Tabor Academy that would significantly increase their wastewater flows.

Inflow/Infiltration Removal

Marion has been engaged in a CMOM program that has included significant efforts to control inflow and infiltration in its sewer system. For estimating future flows, we recognize that much of the past removal efforts are reflected in the flows seen at the WPCF over the past few years. However, consideration may be made to estimated further reductions from continued I&I mitigation efforts in estimating future flows. Based on the I&I removal which has been seen in the last two years of the Town's annual program, the design team expects that Marion may be able to remove approximately 70,000 GPD of inflow and infiltration (average flow basis) by 2029. The reliance on a continuing I&I removal program over the foreseeable future may allow this reduction to be counted in the estimation of future flows.

Summary of Future Flow Ranges

Table 3-7 presents a summary of wastewater flow information, including the average, low, and high total future flow projection for the WPCF.

Table 3-7: Range of Total Future Flows at WPCF

Flow Description	Future Design (MGD)	Low (MGD)	Mid (MGD)	High (MGD)
Existing Flow Total	0.515	0.515	0.515	0.515
Additional Future Flow Total	0.212	0.035	0.128	0.212
Total Future Flow at WPCF	**0.727[1]**	**0.550**	**0.643[1]**	**0.727[1]**

[1] Would require additional NPDES discharge permit capacity.

It is important to note that the wastewater flow projections presented above are intended to illustrate the range of possible flow estimates, depending on the assumptions made in the planning stage. While it is possible for the future flows to be within the current permitted WPCF discharge capacity (0.588 MGD), as shown in the lower projections, most future scenarios suggest average flows which exceed the WPCF permitted capacity. As such, planning for additional treatment capacity is warranted.

3.2.2 *Future Wastewater Loads*

For planning purposes, the anticipated future pollutant loads for the Marion WPCF are summarized in the following Table 3-8. These are based on average daily flows at design conditions, per the above discussion. The observed BOD_5 and TSS loads measured at the WPCF influent sampling location were discussed in Section 2.4.2 of this report. The BOD_5, TSS, and copper loadings presented are based on measured concentrations observed between 2017 to 2020. No specific data or year-round information on influent nitrogen and phosphorus concentrations is available for the Marion WPCF. As such, typical domestic wastewater concentrations are presented for these parameters for planning purposes.

Table 3-8: WPCF Influent Loadings at WPCF Future Design Flow

Parameter	Future Design Loading[1]
Design Flow, ADF	0.727 MGD
BOD_5	151 mg/l 915 lbs/day
TSS	174 mg/l 1054 lb/day
Total Nitrogen	40 mg/l 242 lbs/day
Total Phosphorus	8 mg/l 48 lbs/day
Total Copper	101 µg/l 0.6 lbs/day

[1]These loads are projected raw influent.

While these flow and load values are observed for planning purposes, some detailed refinement of these numbers for loadings will be needed prior to finalization of design options for WPCF improvements.

3.3 Future Regulatory Requirements

Regulatory standards tend to evolve over time, particularly with regard to water quality. Predicting future regulatory requirements for the Town of Marion's wastewater system is as much art as it is science. For the purposes of planning, the following discussion summarizes some of the changes that may be expected associated with key permit parameters. Foremost among these expectations is that the Town should eventually satisfy the requirements of the multiple Consent Orders governing their wastewater operations. After the closure of those regulatory actions, the National Pollution Discharge Elimination System (NPDES) permit will be expected to govern actions and discharges from the Marion WPCF going forward.

3.3.1 *NPDES Permit Expiration and Renewal*

The current NPDES permit for the Marion WPCF is due to expire on November 30, 2022 (the published permit suggest an expiration date of June 30, 2022, but subsequent appeal activity between the Town and EPA resulted in a revised "effective date" for the current permit of December 1, 2017). The Town submitted a renewal application for its NPDES permit on June 3, 2022 and resubmitted with requested updates on August 1, 2022. On September 13, 2022, the Town was contacted by EPA confirming that the application was complete, and that a new draft permit will be issued with provisions for public review and comments. In parallel with the EPA permit process, Massachusetts DEP will issue its own separate permit (Section 401 Water Quality Certification), which is expected to be consistent with the EPA permit. Since Marion's last permit was issued, EPA and Massachusetts no longer cooperate on the joint issuance of the NPDES permits. The Town and other interested parties will have an opportunity to review the draft permit, and the Town should plan to submit comments to EPA (and Massachusetts DEP, as appropriate). EPA will then review and respond to comments and issue the final new NPDES permit, and Massachusetts would be expected to issue the state permit certification at that time as well. The new permit is expected to be in force for a five-year period, as has been the common practice with these permits.

Based on recent history, EPA Region 1 has been slow to issue new draft NPDES permits. The Town's current permit was issued in April of 2017 to replace the prior permit, which was issued in September 2006 (and modified in May 2007). While timing of future permits is unpredictable, it is reasonable to expect that a new NPDES permit for Marion would be issued in 2023, at the earliest.

3.3.2 *Permitted Flows*

While "flow" is not a pollutant per se, EPA has included a limit of average monthly flows in the permits issued in Massachusetts. Without action from the Town, EPA will be expected to continue to issue future permits for the Marion WPCF with an average monthly flow limit of 0.588 MGD, based on a 12-month rolling average. Based on the flows and load projections summarized in this report, the Town will likely need to apply for a higher flow limit when submitting its permit renewal application.

3.3.3 *BOD and TSS*

The current permit includes both concentration and load limits for BOD and TSS. The average monthly and average weekly concentration limits for both BOD and TSS are 9 mg/l and 13 mg/l, while the load limits for these are 42 pounds per day (average monthly) and 63 pounds per day (average weekly). These limits are not expected to change, if the new NPDES permit for Marion were to be based on the same current permitted flow (0.588 MGD). However, if the Town were to request and be granted a higher discharge flow limit, the load limits for BOD and TSS would be expected to be maintained in the new permit. In general, that would mean the WPCF would need to achieve equivalently lower concentrations

at the higher flows to keep the loadings consistent. The actual permit criteria should be a point of discussion with EPA before the permit is finalized.

3.3.4 *Disinfection Requirements*

The current NPDES permit includes limits for both enterococci and fecal coliform to demonstrate disinfection performance. At this time, there is no indication that lower limits would be appropriate or expected for these disinfection standards.

3.3.5 *Nitrogen*

The current permit includes concentration and load limits for ammonia nitrogen, seasonal concentration and load limits for total nitrogen, and monitoring requirements for total kjeldahl nitrogen (TKN) and inorganic nitrogen (total of nitrite plus nitrate). The key constraint on the facility from these limits is the seasonal (April 1 through October 31) limit on total nitrogen. This seasonal (rolling average) total nitrogen limit is currently set at 4.0 mg/l, with an equivalent load limit of 19.6 pounds per day.

Prior to issuance of the current NPDES permit, the draft permit issued for the Marion WPCF included a draft limit of 3.0 mg/l for total nitrogen. After comment from the Town, EPA agreed that the 4.0 mg/l limit was sufficiently protective of the receiving water. However, in the comment response, EPA left the door open to including a more stringent total nitrogen limit in future permits.

As with BOD and TSS, if the Town were to request and be granted a higher discharge flow limit, the load limits for ammonia nitrogen and seasonal total nitrogen would be expected to be maintained in the permit (making it more challenging for the WPCF to meet equivalently lower concentration limits at higher flows).

3.3.6 *Phosphorus*

The current NPDES permit includes seasonal concentration and load limits for total phosphorus. These limits are 200 ug/l and 0.98 pounds per day (both monthly averages), in force between April 1 and October 31, with a monitoring requirement outside those seasonal limits. The regulatory orders (AOC and ACO) currently in place includes a stay on the requirement for the Town to meet these phosphorus limits, and instead requires reporting only of effluent phosphorus. The stay includes the provision for the Town to participate in planning for and evaluation of regional treatment options (which, if selected, could eliminate the need for a discharge permit for the Marion WPCF). If the Town concludes that regionalization is not an option, or ceases to participate in the regional planning efforts, the stay on the total phosphorus limit would be lifted. Barring a change in the discharge location, the Town should expect that the seasonal phosphorus limits in the permit (200 ug/l and 0.98 pounds per day) will continue to be a part of future permit conditions. It is also possible that a winter (November 1 to March 31) limit on phosphorus (previously proposed as 1.0 mg/l) could be included in future discharge permits.

3.3.7 *Copper*

The current permit includes a copper discharge limit of 7.7 ug/l (average monthly) and 11.3 ug/l (maximum daily). The Administrative Order (AO) currently in place includes a stay on these limits, and an interim copper limit of 20 ug/l. Prior to issuance of the current NPDES permit, the draft permit issued for the Marion WPCF included lower limits of 3.73 ug/l (average monthly) and 5.78 ug/l (maximum daily) for total copper. After comment from the Town, EPA agreed that the prior permit limits were appropriate. However, the possibility of a more stringent copper limit in future permits should be considered. Barring

a change in the discharge location, the Town should expect that the interim copper limit will lapse and the more stringent NPDES permit copper limits will continue to be a part of future permit conditions.

3.3.8 *Other Pollutants & Permit Considerations*

The US EPA and Massachusetts DEP continue to review the need for changes to permit conditions, and occasionally will introduce new limits. While not all of these changes are predictable, there are some areas where some expectation of future limits can be offered based on past and recent similar permitting. Two of these permit considerations – aluminum and PFAS, are discussed further herein.

One area where other facility permits have been issued that may become relevant to Marion is metals limits. As Marion looks to adapt its treatment process to remove phosphorus in the future, the use of metal (iron or aluminum) salts is a likely approach. If the Marion WPCF implements the use of an aluminum-based precipitant, the EPA will likely re-evaluate the reasonable potential calculation for aluminum in the plant effluent. This may result in a future aluminum limit being added to the NPDES permit.

A more recently developing permit consideration is the inclusion of PFAS compounds in wastewater discharge permits (currently, monitoring provisions only have been included in permits). Beginning in latter part of 2020, EPA Region 1 began issuing draft NPDES permits that include requirements for sampling and reporting on per- and poly-fluoroalkyl substances (PFAS), including required testing of influent wastewater, treated effluent discharge, and sludge from the WPCF. These new permit requirements include the six PFAS compounds identified in the Massachusetts Drinking Water Standards (PFHxS, PFHpA, PFNA, PFOS, PFOA and PFDA). In addition, the recent draft permits include provisions for annual testing of local industrial dischargers for PFAS compounds under the Industrial Pretreatment Program (IPP) requirements. While limits on PFAS discharges have yet to be established, EPA and DEP have made clear that their eventual intention is to set such limits for inclusion in NPDES permits in Massachusetts.

In addition to new pollutant limits, EPA included enhanced provisions related to dissolved oxygen (DO) sampling in the prior permit draft. EPA expressed a concern for DO levels in the receiving waters, and the permit and appeal process included significant discussion of DO monitoring protocols in the receiving waters. Additional discussion of DO provisions may be expected as part of the next discharge permit.

3.4 Future Budget and User Rate Considerations

Based on review of the components of the current wastewater department budget, it is expected that future budgets will present similar financial challenges for Marion. Major debt service line items will remain a part of the budget for the next decade because of the longer (30 year) term selected for financing past capital costs. No significant items were identified that are likely to decrease over time, and most costs will continue to increment higher due to relative inflation impacts. Lacking any significant increase in the user base, annual use charges to connected properties are expected to continue to be relatively high.

3.5 Future Regional Considerations

Regional considerations related to wastewater are expected to be similar in the future. The two primary regional neighbors with wastewater systems will remain to be Mattapoisett (to Fairhaven) and Wareham. The only significant change being considered is the possible regional expansion of the Wareham

treatment system and the related outfall extension to the Cape Cod Canal. At the current time, it is unclear if the ongoing Wareham planning effort will result in an implementable project. It is reasonable to expect that any project of that nature would have a timeline on the order of 10 years to complete planning, permitting, design and construction. The Town of Marion continues to seek updated information on the Wareham regional planning process. Regionalization options will be addressed in the Alternatives section of this CWMP.

4.0 IDENTIFICATION OF WASTEWATER NEEDS

Wastewater management needs for the Town of Marion can generally be categorized as individual property wastewater needs, such as the need for off-site sewage disposal, and existing wastewater collection system and treatment needs. For the former, many parts of Town are served by individual, on lot (Title 5) septic systems. Several of these areas have been identified as potentially needing an off-site solution such as municipal sewer extensions. For the existing municipal system, needs tend to be related to system condition, capacity, or other changes – such as permit conditions. Each of these types of needs are discussed in the following sections.

4.1 On-Site System and Unsewered Parcel Needs

More than one third of all currently developed parcels in Marion use on-site septic systems to treat and dispose of wastewater. One of the fundamental challenges to water resource management in Marion is preserving the health of local embayments through nitrogen reduction. While there are several sources of nitrogen in Buzzards Bay, including cranberry bogs, fertilizer and impervious area run off, wastewater is one that has been targeted by Marion as a source of nitrogen that can be further reduced through efficient and focused treatment techniques.

4.1.1 *On-site System Challenges*

The initial step in the comprehensive wastewater management planning process was the identification of areas in the Town of Marion with long-term challenges using on-site wastewater treatment and disposal systems.

4.1.1.1 Nitrogen Loading

Nitrogen loading to the embayments surrounding Marion is a significant concern for the Town and local environmental groups. As is discussed in greater detail in Section 1.2.1.3, portions of several waterbodies in Marion have impairments for nitrogen: the Weweantic River, Aucoot Cove, Aucoot Creek, Hammett Cove, and "Inner" Sippican Harbor. In Massachusetts, Section 310 CMR 15.000, the State Environmental Code (Title 5) governs standard requirements for on-site systems, including those for nitrogen removal. Traditional septic systems designed to meet Title 5 standards achieve minimal nitrogen removal, approximately 25%, compared to more robust treatments. Septic systems designed for enhanced nitrogen removal, as have been required in Marion since June 2020, are assumed to achieve an improved 50% nitrogen removal. These systems are required for new system installations and for failed systems that need to be replaced. Once installed, the enhanced nitrogen removal systems need to be operated and maintained to achieve a system performance target of 19 mg/l or less for total nitrogen in their effluent discharged to the ground.

Even with the increased nitrogen removal requirements of the Town's *Septic System Denitrification Regulation*, the greatest nitrogen removal is achieved by treatment at an advanced wastewater treatment facility. Marion's WPCF regularly achieves greater than 90% removal of Total Nitrogen. In fact, in 2020 the Marion WPCF discharged high quality effluent with an average of 2.8 mg/l Total Nitrogen, which is close to the limit of technology for such treatment systems. Therefore, the Town's Board of Health (BOH) views connecting a property to Town sewer to be the optimal method of decreasing wastewater-related Nitrogen loading to the local embayments and requires that properties connect to Town sewer if it becomes available. When connecting to Town sewer is not possible, the BOH administers the septic system regulations.

4.1.1.2 Insufficient Area

The existing sewer system initially focused on the Marion Village area, leaving many areas with small parcel sizes unsewered outside of this central area. Despite current zoning requiring that the smallest residential district, Residence A, have a minimum lot size of 0.5 acres, there are many parcels in Marion, built and unbuilt, which are even smaller. Most of these small parcels required variances from the Title 5 rules and regulations or they were allowed to build a replacement system using the provisions within Title 5 to comply to the extent possible. The maximum feasible compliance relief granted for such systems that cannot fully comply have allowed for leaching system area reductions up to 25% of the Title 5 requirements and have allowed for reductions in the separation to groundwater and proximity to property lines. Undersized lots with less robust on-site systems are not ideal for nutrient removal.

4.1.1.3 Proximity to Resource Areas and Flood Plains

Marion's coastal geography means that many parcels are located on peninsulas, coves, and islands, in proximity to resource areas and within flood plains. Original on-site systems, which were generally cesspools, were sometimes positioned close to wetlands, rivers, and in some cases were in the flood plain. When a system failed, a second cesspool, overflow trench, field, or a direct pipe to the river, stream, or wetlands was added. With the advent of environmental awareness and regulations, these environmentally sensitive areas required additional setbacks to protect them from potential wastewater impacts. Existing parcels often lacked the required space to comply with the regulations. This resulted in informal and sometimes formal relief in the form of a variance from one or more of the dimensional setbacks and to some extent diminished protection of the resource areas. In Marion, protection of these resource areas now comes in several forms, as described in Section 2.1.4.

4.1.1.4 High Groundwater

In some areas, high groundwater is an issue because adequate removal of pollutants such as nitrates and phosphates, as well as pathogens, takes place as the effluent filters through the unsaturated ground below the leaching area. If there is not enough separation between the leaching system and the groundwater level, limited treatment occurs, and these substances may enter the groundwater. This is a concern for two reasons: first, because the Town obtains the entirety of its drinking water, both municipal and private, from the groundwater supply; and secondly, because of the potential impact on other environmental resources. In order to protect groundwater, Title 5 requires a minimum four-foot separation between the bottom of the leaching system and the groundwater level for percolation rates slower than two minutes an inch. In sandy material, where water movement through the soils is quite rapid with rates less than or equal to two minutes an inch, an additional foot of separation is required to allow for adequate treatment and removal of contaminants in the wastewater. Full compliance with these provisions is sometimes impossible especially where existing homes were constructed such that the foundation has minimal concrete reveal or low windowsills prohibiting re-grading of the yard to allow for raising of the septic system. Approval of new systems in areas of high groundwater, often requires relief of at least one foot from the groundwater separation requirement and possibly the construction of retaining walls to minimize problems with breakout. This can often result in awkward and unsightly transitions to other features within the yard.

The method of determining the depth to or elevation of groundwater has changed quite a bit over time. Early systems designed and installed before a public health regulation had been established resulted in systems that were installed in or near the seasonal high groundwater elevation. These leaching systems were connected hydraulically to the water table, but no purification of the effluent occurred. Even when regulations were promulgated in 1978 to provide for a four-foot separation, the majority of

septic systems were still constructed too low. Groundwater from 1978 to 1994 was the observed depth of water in the test pit excavated when the percolation test was completed. Percolation testing season generally ran from November 1st to June 1st and given the year to year seasonal variability, a dry season may suggest that water is much lower than the actual annual high water elevation. The end result was and is that systems often times were constructed below or just above the water table. These systems would function for an extended life span because of the submersion but the treatment of the effluent was inadequate. Only anaerobic bacteria are present in this scenario depriving the cleaning of wastewater in the unsaturated zone by aerobic bacteria.

To build or upgrade septic systems on many parcels in areas of high groundwater, the systems have been and will continue to be built as mounded leaching systems to achieve this separation. Mounded systems can be less than desirable aesthetically and are generally more costly to construct. Request for waivers from strict compliance are typically requested and granted for house lots where foundations are close to existing grade. Granting of separation relief is consistent with the provision of Maximum Feasible Compliance but does reduce aerobic contact by 20 percent for a 5-foot to 4-foot separation and 25 percent reduction in contact for a 4-foot to 3-foot separation. These systems often require a pump chamber to lift the effluent portion of flow from the septic tank to an elevated leaching area.

4.1.1.5 Soils and Bedrock

Some lots have challenges involving the type of soil that exists in their area or with the presence of bedrock close to the ground surface. These are difficult challenges to overcome and often require the footprint of the leaching area to be larger or mounded, which again leads to more costly construction and more challenging design, especially with existing building foundations at lower elevations. The most challenging soils are related to silt, clay and dense glacial till. These types of compact and fine-grained soils have extremely slow percolation rates and also impede vertical movement of water resulting in a perched water table. Both conditions are not desirable for septic systems. Variances from system size requirements and setbacks to property or foundation are common. Reductions in groundwater separation to minimize the grading changes are often sought from the BOH in the form of a variance. Many of these were done with approval of the Health Agent.

4.1.1.6 Local and State Waivers/ Variances

Property owners who are looking to install a new septic system, or who need to upgrade or expand their existing system that does not meet the requirements of Title 5 and/or the more stringent denitrifying regulations for reasons described in this section, are able to apply for waivers and/or variances from the regulations. For existing systems, the goal is to achieve maximum feasible compliance.

Upgrades to existing systems are the result of failure of the septic system to adequately recharge leachate into the ground. Such failures can be the result of eventual clogging of the soils, biomass buildup and from poor maintenance or groundwater failure (mostly for systems designed prior to 1995). Other reasons to upgrade include Title 5 Inspection failures, and the desire to increase the amount of flow to the system. This can occur when bedrooms are added to residential homes or when a change of use mandates a system upgrade. Except for increases in design flow and changes in use, the waivers allowed under the provisions of “Maximum Feasible Compliance” apply.

For upgrades of existing systems, the regulations allow for maximum feasible compliance, which allows for deviation from the strict requirements for new systems. The goal is to replace the system with a system that comes as close to that required for new construction except where site constraints prohibit

strict compliance. If an upgrade is approved with the waivers of groundwater separation, distance to property line or cellar wall etc., the stipulation is that the flow cannot be increased from the present level. Since the elevation of the house foundation was typically determined by less scientific methods prior to 1995, replacement septic systems often require relief from the required separation to groundwater in order to avoid systems with finished grades higher than the top of foundation.

Other typical waivers include reductions in the soil absorption system separation to property lines, cellar walls and even wetlands. Often the wetland issue is the result of systems that were constructed prior to the advent of the Wetlands Protection Act which was enacted in the late 1970s. Prior to that time, wetlands could be legally filled as part of a development project, and systems were often closer than 50 feet to a wetland.

Board of Health (BOH) variances from local and state regulations are possible but the justification for granting of such variances must be clearly shown. In recent years, there has been a move to shift responsibility for granting such relief to the local BOH as the Department of Environmental Protection (DEP) has transferred responsibility for certain approvals to the municipalities. Previously, a variance would need to be granted by the BOH, and then, a separate variance request would be filed with the DEP. This process would sometimes take several months to complete usually during a time when the septic system is in failure.

The total number of local and state variance requests identified by the Marion Board of Health were relatively few since 1995 and are not tabulated by the BOH. As part of this CWMP effort, 72 properties were identified as having received approved variances since 2000. Those variances that are known and were approved since 2000, can be seen on the figures for each unsewered needs area and are shown in the following section, Section 4.1.2. Table 4-1 shows that most granted variances were approvals due to high groundwater.

Table 4-1: Variances in Marion Granted Since 2000

Variance Description	Number of Variances[1]
Inadequate Setback/ Lot Size	31
High Groundwater	53
Lessened Capacity	12
Other[2]	22

[1] Some variances fit into multiple description categories
[2] Other includes but is not limited to sieve testing in lieu of standard percolation tests

4.1.2 *Unsewered Needs Areas*

According to Town sewer user records, there are over 1,700 parcels within the Town that are currently served by Town sewer. In addition, there are approximately 940 parcels with buildings not served by Town sewer, and approximately 950 vacant parcels without any treatment needs. A needs analysis was performed to determine which of the current areas of Town, which are not currently sewered, could benefit from a centralized collection and treatment solution, requiring potential future sewer connections to the conveyance system and flow to the WPCF. To better focus the analysis, areas identified in the prior 2001 CWMP were reviewed and other developed, unsewered areas were discussed with Town staff; the resulting eleven (11) areas were identified as potential “Needs Areas” for future sewer

connections and transitioning from on-site-systems. The location of these areas throughout the Town are shown in Appendix A and described in Table 4-2 below:

Table 4-2: Unsewered System Needs Areas

Needs Area	Location Description	Number of Lots or Potential Connections[1]
River Road/ Wareham Road	River Road, Green Street, Hill Street Neighborhoods Along Wareham Road	82
Delano Road/ Weweantic River	Cross Neck Road and Delano Road	33
Wings Cove/ Piney Point	Point Road and Holly Road	196
Lower Sippican Neck	Point Road and Planting Island Road	38
Planting Island	East Avenue and West Road	79
Allens Point/ Harbor East	Allens Point Road and West Drive	34
Converse Point	Converse Road and Moorings Road	26
Aucoot Cove	Mill Street, Holly Pond Road, and Indian Cove Road Neighborhood	44
Lower Mill Street	Mill Street from Parlowtown Road and Rocky Knook Lane	111
Upper Front Street/ Route 105	Front Street and Brook Haven Lane	99
County Road	County Road and Point Road	53

[1] Further defined in later report subsections, based on property development or future development potential.

The needs analysis for these 11 identified areas is detailed in the following sections. The preliminary review focused on the challenges facing on-site systems, as presented in the preceding section(Section 4.1.1) and used the following information/methodology to determine potential needs for an off-site wastewater management solution. Towards the end of this section, in Table 4-25, Unsewered Needs Area Summary Initial Prioritization, the various components of the needs analysis are presented. This initial ranking compares each needs area to the other with regard to these components to prioritize future action.

- Inventory of Board of Health Septic System Records – Current records of septic system construction, repairs, and granted variances are maintained as hard copy files at the Board of Health (BOH). These files were somewhat limited; however, available files were reviewed for variances that were granted after the year 2000 and to identify areas where common septic system installation and maintenance challenges were identified and documented. More detail on variances is included in the following discussions of each needs area. In conjunction with review of Tax Assessors data for building ages, estimates of septic system ages were prepared. Typical on-site systems have a useful life expectancy of around 40 years; however system failure is not imminent at that time. A system over this age is anticipated to need some repair or replacement at some point during the 20-year planning period of this CWMP, therefore average estimated system age was considered in the needs analysis. Though the BOH records are believed to be representative of the status of on-site systems in Marion, it should be noted that the records available may not fully capture of all system improvements if records were not provided to the BOH.

- Wetland and Floodplain Boundaries – Boundaries of wetlands and flood plains were mapped to identify sensitive receptors which could limit development and placement of on-site systems.

- Land Use Designations, Zoning Districts, and Lot Sizing– Land use designations, zoning districts, and lot sizes were used to identify conditions which restrict on-site system design and siting.

- Nitrogen Loading Calculations – For each needs area, an estimated best- and worst-case nitrogen load was calculated based on the number of existing on-site systems and the number of possible new on-site systems. Existing systems were expected to contribute between 26 mg/L (best-case) and 42 mg/L (worst-case) of total nitrogen[5]. New (future) on-site systems were expected to contribute 19 mg/L, per Marion's Septic System Denitrification Regulation described in Section 2.1.4.6. This range of estimated nitrogen contribution is intended to show that even well-functioning septic systems will potentially contribute excess nutrients to the environment and better depict the "No Action" condition. General assumptions about the receiving waters of this nitrogen load were made based on proximity to the needs area, but no detailed hydrogeologic analysis was done for this preliminary assessment. Areas in proximity to an impaired water body (based on Section 303d list review) were considered a higher priority for off-site wastewater management.

- Soil Characteristics – Soil profiles of parcels were evaluated to soils whose characteristics are least conducive to on-site system design standards and environmental protections.

- Water Supply Protection Zones – A review of water supply protection considerations, including Marion's Water Supply and Aquifer Protection Overlay Districts, was performed to evaluate development within and proximate to water supply sources.

- Discussions with Town Officials – Discussions were held with Town officials to gain first-hand information on other local considerations for off-site solution recommendations.

For each identified area, a review of the above information was used as evaluation criteria in determining the priority of needs for an off-site solution. These reviews are discussed in the following sections (the order of discussion is not intended to convey priority), and a summary of the information analyzed, and the resulting needs priority is presented in Section 4.1.2.12.

[5] Source: October 2020 Article *Distributed Nitrogen Removing I/A Septic Systems: A 2020 Primer for Cape Cod* by Bruce Walton

4.1.2.1 River Road/ Wareham Road Needs Area

The River Road/Wareham Road needs area is located along Wareham Road between Point Road and River Road, including the Hill Street and Green Street neighborhoods. Figure 4-1 shows the extents of the River Road/ Wareham Road needs area.

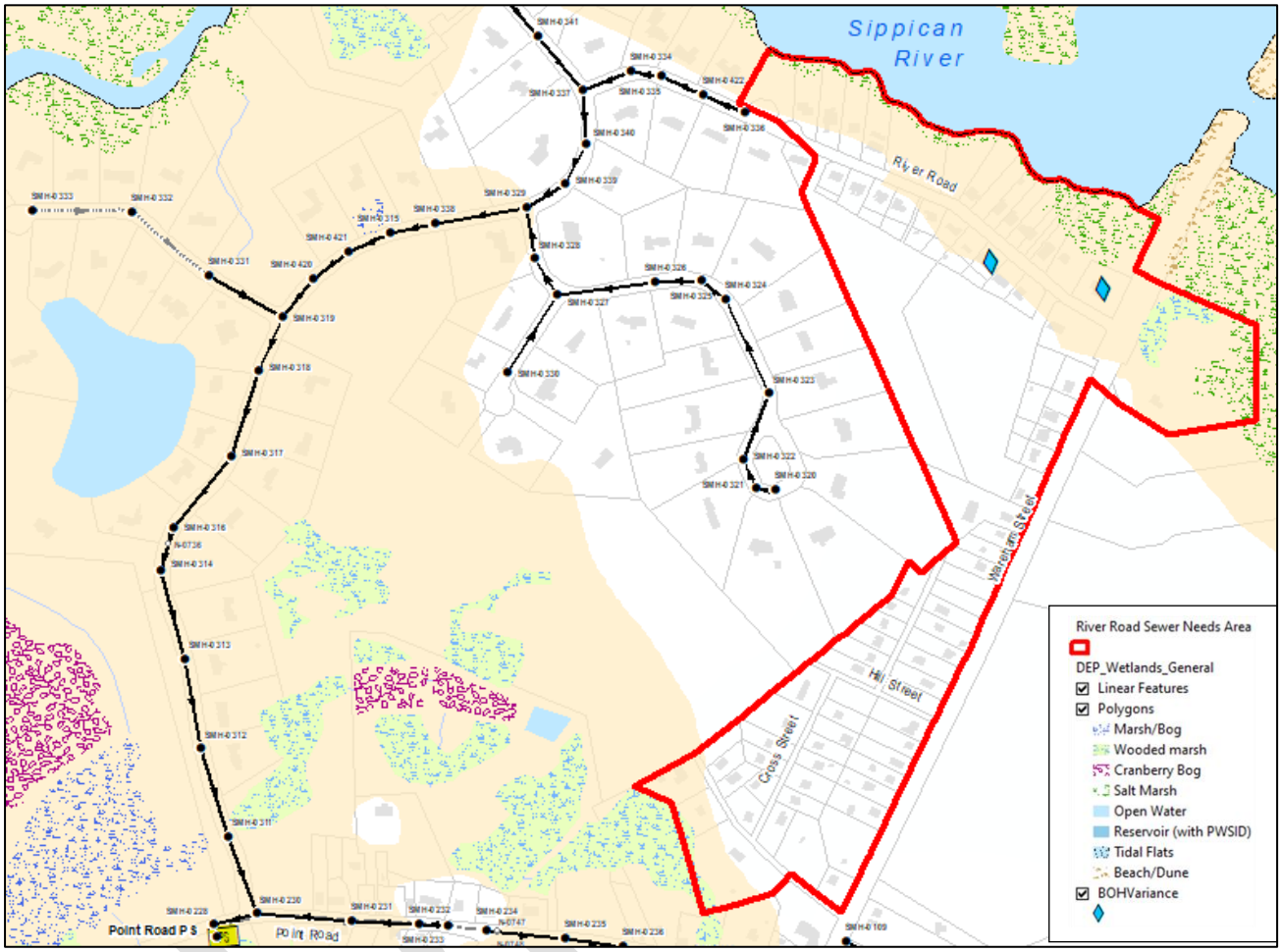

Figure 4-1: River Road/ Wareham Road Needs Area

The River Road/ Wareham Road needs area is currently served by private on-site systems and is comprised of 84 total parcels, 82 of which have been determined to be potential sewer connections. The parcels of this needs area are characterized as follows:

84 Total Parcel Lots

- 77 Parcel Lots with Existing Buildings
  - Average lot size is 0.55 acres
  - Average age of home (and likely septic system) is 42 years
  - 1 Septic System Upgrade, 1 Septic System Repair Documented over the last 20 years
- 7 Vacant Parcel Lots
  - 5 Developable Vacant Parcel Lots (based on current zoning)
- 2 Parcel Lots Have Been Granted Board of Health Variances for On-Site Design Systems
- Wetlands and 100 Year Flood Plain Areas are Present Along Various Lots

Each criterion used to prioritize needs in each unsewered needs is explored for the River Road/ Wareham Road needs area below:

Board of Health Records: At 42 years, the average age of the existing septic systems is beyond their 40-year life expectancy. As shown in Figure 4-1, only two parcels (3% of all parcels) in the needs area have been granted variances for on-site systems since 2000. The limited number of variances indicates that there has not been significant, known challenges to fulfilling title 5 requirements for existing on-site systems in the needs area. However, the average age of systems indicates that these systems may require increased frequency of repair or replacement in the future.

Wetlands & Floodplain Boundaries: Based on information shown in Figure 4-1, approximately 33% of the needs area (primarily along River Road) lies within the 100-year floodplain and within the riverfront wetland area for the Sippican River/Weweantic River. There are some, limited wetlands present but none prevalent enough to challenge the siting of on-site systems in the majority of parcels in this needs area. The floodplain, however, makes it difficult to site on-site systems on the parcels along the river side of River Road.

Land Use, Zoning, & Lot Sizing: The projected future wastewater flow for the River Road/ Wareham Road area is based on the zoning characteristics of the area as shown in Figure 4-2 and Table 4-3. The needs area is zoned primarily residential, with only six parcels zoned commercial. An average parcel size of just over half an acre is generally sufficiently large enough for siting on-site systems. Similarly, the zoning and land use are not expected to pose challenges to the use of on-site systems in the future. Based on zoning, the projected average day flow is estimated to be 14,000GPD for all parcels either already developed or able to be developed in the future.

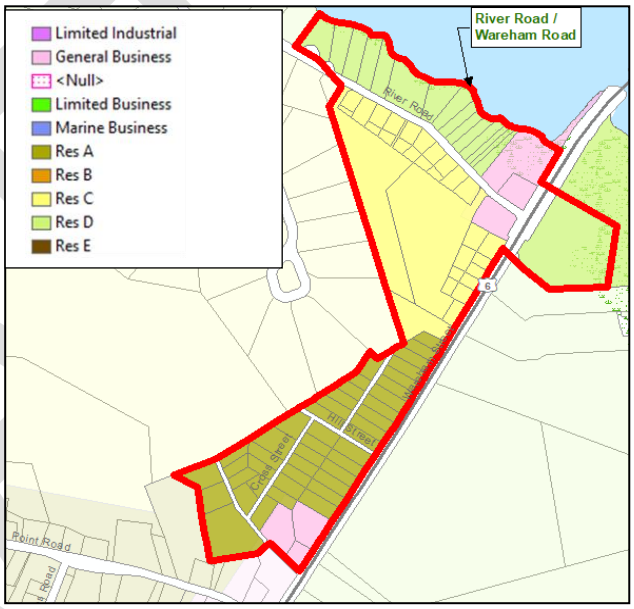

Figure 4-2: River Road/ Wareham Road Needs Area Zoning Map

Table 4-3: Projected Sanitary Flow - River Road / Wareham Road Needs Area

Zoning District	% of Land Area	Number of Lot Connections	Flow Rate Per Lot - Max Day (GPD)	Projected Max Day Flow (GPD)	Projected Average Day Flow (GPD)[3]
General Business	6	6	400[1]	2,400	1,200
Residence A	43	78	330[2]	25,700	12,900
Residence C	19				
Residence D	16				
			Total Future Flow Projection	**28,100**	**14,000**

[1] Calculated Town Wide General Business Average Flow Per Lot from Existing Billing Information
[2] Assumes 3 Bedrooms Per Lot, Multiplied by 110 GPD Per Bedroom
[3] Assumes Average Day Flow = 1/2 * Max Day Flow

Nitrogen Loading: Several of the parcels in this needs area along River Road border the Sippican River and its confluence with the Weweantic River. Both rivers have state-listed impairments for bacteria and the Weweantic River has an additional impairment for total nitrogen. Figure 1-6 (attached) shows impaired water bodies. If no action is taken in the River Road/ Wareham Road needs area, it is estimated that this needs area would contribute 3.0 lb/day – 4.8 lb/day of total nitrogen to the Weweantic River, based on the total future flow projection of 14,000 GPD. Reducing nitrogen load to the Weweantic River is a high priority and thus the continued, high contribution of nitrogen from on-site systems in this area presents a challenge to the continued use of on-site systems here.

Soil Characteristics: Soils in this area are mostly well draining, as shown in Figure 4-3 and Table 4-4. The portions of this area with soil types outside of this category, particularly the parcels along River Road with excessively draining soils, will likely encounter challenges siting a fully compliant septic system in the future.

Table 4-4: Soil Drainage Distribution for River Road/ Wareham Road Needs Area

Soil Description	% of Land Area
Excessively Draining	17
Well Draining	70
Moderately Draining	8
Very Poorly Draining	5

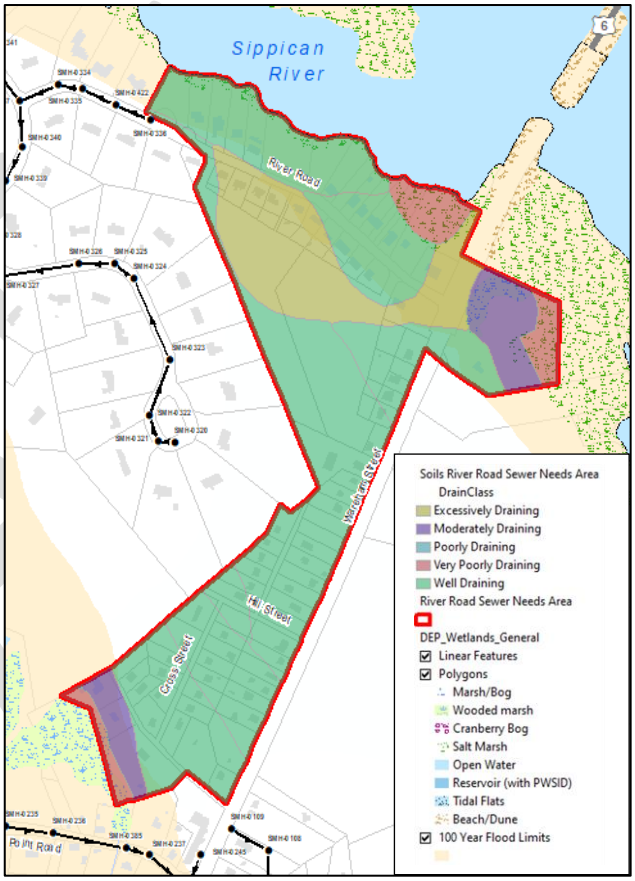

Figure 4-3: River Road/ Wareham Road Needs Area Soils Profile

Water Supply Protection: There are no known DEP water resource areas Zone A, Interim Wellhead Protection Areas (IWPAs), Wetland Protection Zone 1, DEP Approved Zone 2, or Public Water Supply Wells near this needs area. Therefore, there are no known water supply concerns for this area.

Priority Conclusions: These criteria represent environmental constraints to development and on-site system siting in the needs area. While continued use of on-site systems is possible for this area, a net reduction in nitrogen loading would require installation of enhanced on-site systems. With no change to the current regulations, these upgrades are required under certain circumstances; however, it is difficult to predict the timeline of required upgrades. Therefore, this area is assigned a high priority for off-site treatment and disposal, due mainly to its proximity to the Sippican and Weweantic Rivers and the potential for nitrogen contribution to those resources, if this area remains on-site. As a secondary consideration for this area, the Town identified that new developments are pending in the area on Wareham Road that, if approved, would likely add new sewers on Wareham Road (extending from Point Road).

4.1.2.2 Delano Road/ Weweantic River Needs Area

The Delano Road/ Weweantic River needs area is located along Delano Road near Cross Neck Road. Figure 4-4 shows the extents of the Delano Road/ Weweantic needs area.

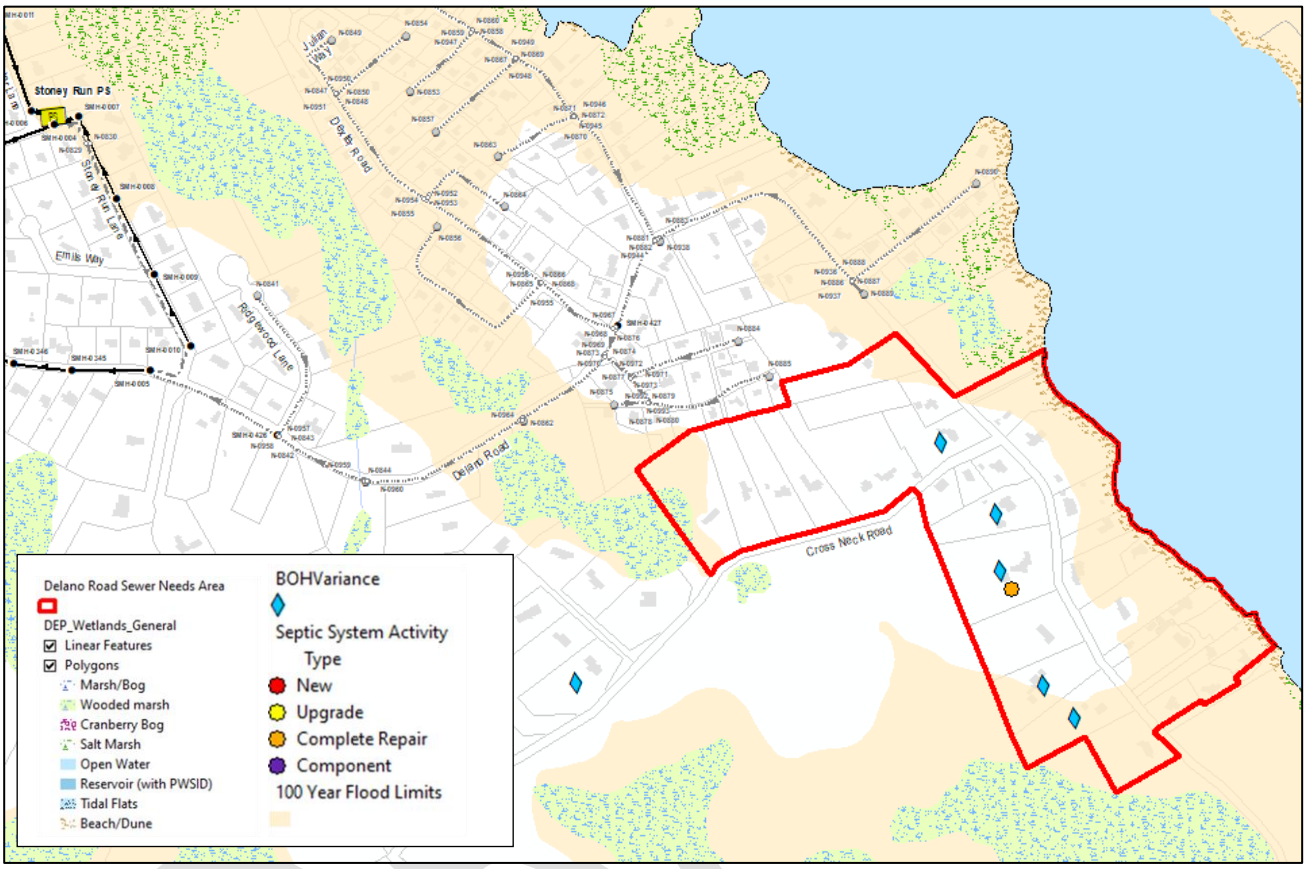

Figure 4-4: Delano Road / Weweantic River Needs Area

The Delano Road/ Weweantic River needs area is currently served by private on-site systems and is comprised of 33 total parcels, all of which have been determined to be potential sewer connections. The parcels of this needs area are characterized as follows:

33 Total Parcel Lots

- 31 Parcel Lots with Existing Buildings
  - Average lot size is 1.2 acres
  - Average age of home (and likely septic system) is 48 years
  - 1 Septic System Repair Documented over the last 20 years
- 2 Vacant Parcel Lots
  - 2 Developable Vacant Parcel Lots (based on current zoning)
- 5 Parcel Lots Have Been Granted Board of Health Variances for On-Site Design Systems
- Wetlands and 100 Year Flood Plain Areas are Present Along Various Lots

Board of Health Records: At 48 years, the average age of the existing septic systems is beyond their 40-year life expectancy. As shown in Figure 4-4, five parcels (17% of all parcels) in the needs area have

been granted variances for on-site systems since 2000. This percentage of variances is higher compared to most other needs areas, indicating that there have been challenges to fulfilling title 5 requirements for existing on-site systems in the past. Additionally, the average age of systems indicates that these systems may require increased frequency of repair or replacement in the future.

Wetlands & Floodplain Boundaries: Based on information shown in Figure 4-4, approximately 41% of the needs area (primarily along Delano Road) lies within the 100-year floodplain and riverfront wetland area for the Weweantic River. There are no wetlands present that would pose a challenge to the siting of on-site systems in this needs area. The floodplain, however, makes it difficult to site on-site systems on the parcels along much of Delano Road.

Land Use, Zoning, & Lot Sizing: The projected future wastewater flow for the Delano Road/ Weweantic River area is based on the zoning characteristics of the area as shown in Figure 4-5 and Table 4-5. The needs area is zoned residential. An average parcel size of approximately 1.2 acres is, in general, sufficiently large enough for siting on-site systems. Similarly, the zoning and land use are not expected to pose challenges to the use of on-site systems in the future. Based on zoning, the projected average day flow is estimated to be 5,500 GPD for all parcels either already developed or able to be developed in the future.

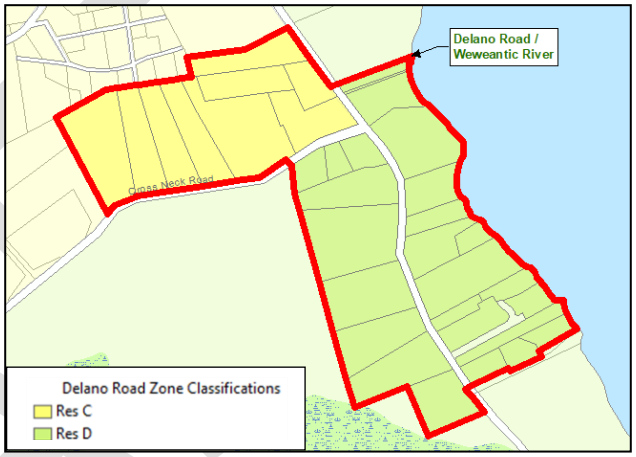

Figure 4-5: Delano Road/ Weweantic River Needs Area Zoning Map

Table 4-5: Projected Sanitary Flow – Delano Road / Weweantic River Needs Area

Zoning District	% of Land Area	Number of Lot Connections	Flow Rate Per Lot - Max Day (GPD)	Projected Max Day Flow (GPD)	Projected Average Day Flow (GPD)[2]
Residence C	26	33	330[1]	10,900	5,500
Residence D	74				
			Total Future Flow Projection	10,900	5,500

[1] Assumes 3 Bedrooms Per Lot, Multiplied by 110 GPD Per Bedroom
[2] Assumes Average Day Flow = 1/2 * Max Day Flow

Nitrogen Loading: Several of the parcels in this needs area along Delano Road border the Weweantic River, which has numerous impairments including total nitrogen. Figure 1-6 (attached) shows impaired water bodies. If no action is taken in the Delano Road/ Weweantic River needs area, it is estimated that this needs area would contribute 1.2 lb/day – 1.8 lb/day of total nitrogen to the Weweantic River, based on the total future flow projection of 5,500 GPD. Reducing nitrogen load to the Weweantic River is a high priority and thus the continued, high contribution of nitrogen from on-site systems in this area presents a challenge to the continued use of on-site systems here.

Soil Characteristics: Soils in this area are primarily well or moderately draining, as shown in Figure 4-6 and Table 4-6. Only small portions of this needs have poorly or very poorly draining soils and are found in parcels that also have well or moderately draining soils. Therefore, the drainage characteristics of the soils in this needs area are not expected to be a challenge to siting fully compliant septic systems in this needs area in the future.

Table 4-6: Soil Drainage Distribution for Delano Road/ Weweantic River Needs Area

Soil Description	% of Land Area
Well Draining	58
Moderately Draining	37
Poorly/ Very Poorly Draining	5

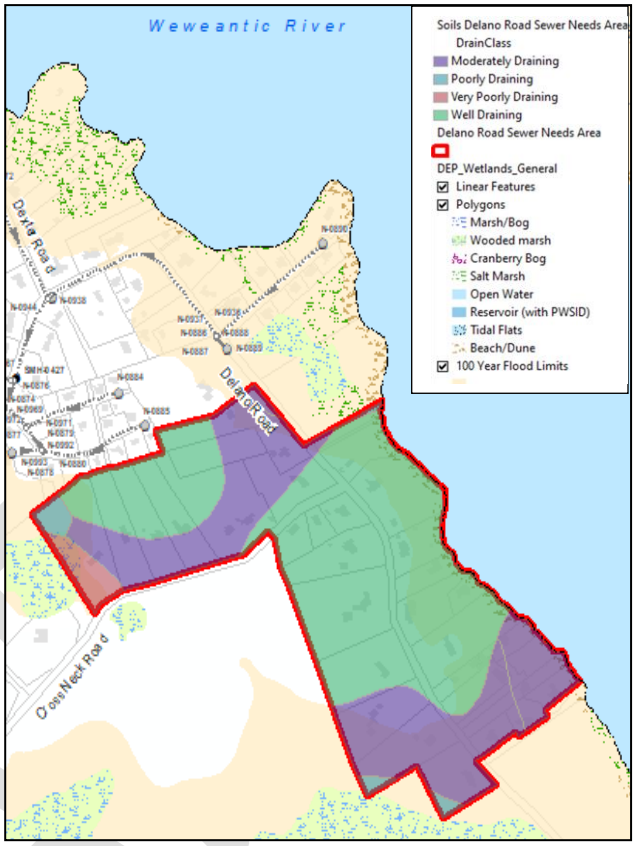

Figure 4-6: Delano Road / Weweantic River Needs Area Soils Profile

Water Supply Protection: There are no known DEP water resource areas Zone A, IWPAs, Wetland Protection Zone 1, DEP Approved Zone 2, or Public Water Supply Wells near this needs area. Therefore, there are no known water supply concerns for this area.

Priority Conclusions: These criteria represent environmental constraints to development and on-site system siting in the needs area. While continued use of on-site systems is possible for this area, a net reduction in nitrogen loading would require installation of enhanced on-site systems. With no change to the current regulations, these upgrades are required under certain circumstances; however, it is difficult to predict the timeline of required upgrades. The high percentage of variances in the area indicate that even new or upgraded systems may not be able to achieve full compliance, however with the size of lots in this area allows for siting options. Therefore, this area is assigned a lower priority for off-site treatment and disposal.

4.1.2.3 Wings Cove/ Piney Point Needs Area

The Wings Cove / Piney Point needs area is located along Point Road, south of Delano Road. Figure 4-7 shows the extents of the Wings Cove/ Piney Point needs area.

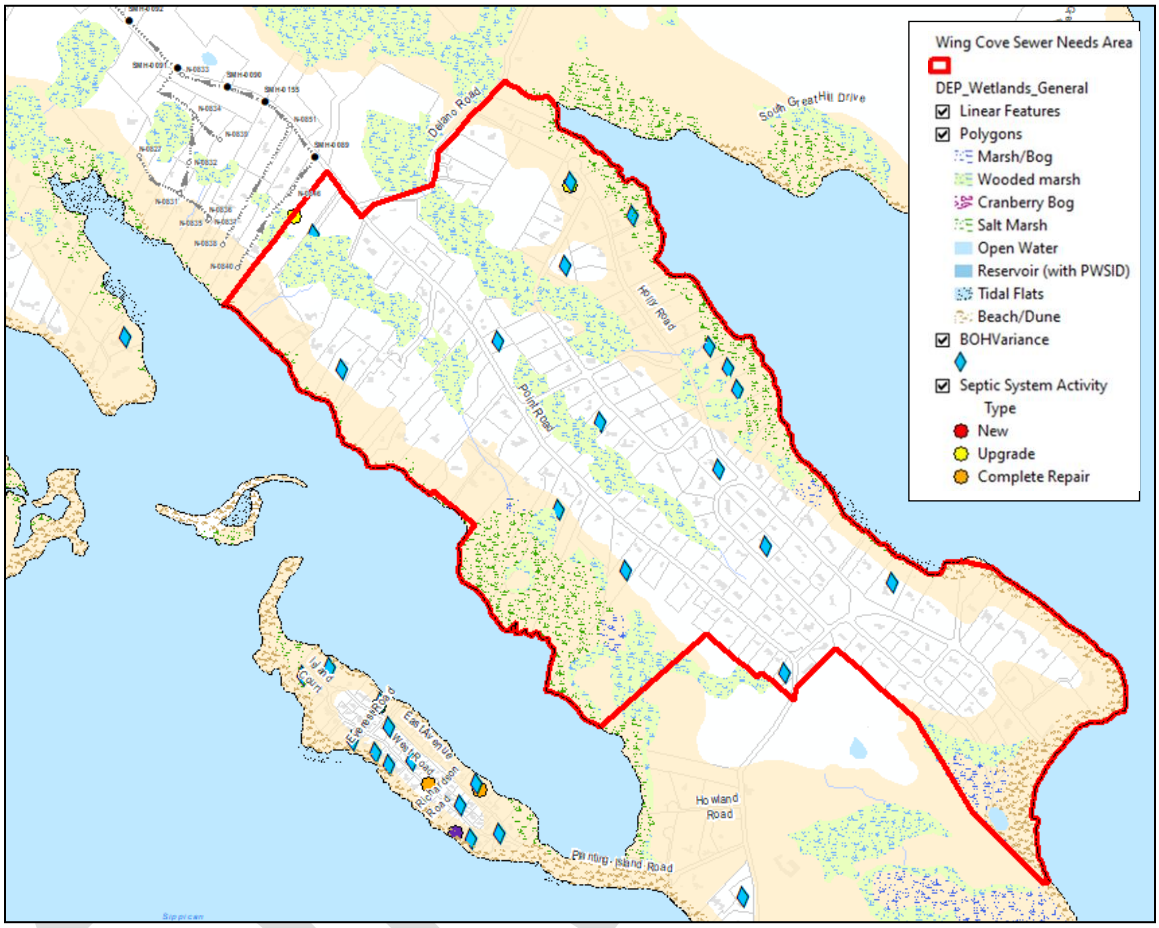

Figure 4-7: Wings Cove / Piney Point Needs Area

The area is currently served by private on-site systems including approximately 217 parcels, 196 of which have been determined to be potential sewer connections. The parcels of this needs area are characterized as follows:

217 Total Parcel Lots

- 180 Parcel Lots with Existing Buildings
  - Average lot size is 1.80 acres[6]
  - Average age of home (and likely septic system) is 59 years
  - 2 Septic System Upgrades Documented over the last 20 years
- 37 Vacant Parcel Lots
  - 16 Developable Vacant Parcel Lots (based on current zoning)
- 16 Parcel Lots Have Been Granted Board of Health Variances for On-Site Design Systems
- Wetlands and 100 Year Flood Plain Areas are Present Along Various Lots

[6] Lot sizes vary significantly in the area, and typical lots of approximately one acre in size are common.

Board of Health Records: At 59 years, the average age of the existing septic systems is beyond their 40-year life expectancy. As shown in Figure 4-7, sixteen parcels (10% of all parcels in the needs area) have been granted variances for on-site systems since 2000. This number of variances indicates that there has not been significant nor consistent known challenges to fulfilling title 5 requirements for existing on-site systems in the needs area. However, the average age of systems indicates that these systems may require increased frequency of repair or replacement in the future.

Wetlands & Floodplain Boundaries: Based on information shown in Figure 4-7, approximately 42% of the needs area (primarily the coastal parcels) lies within the 100-year floodplain. Additionally, there are large swaths of wetlands present that would pose a challenge to the siting of on-site systems in this needs area. Together, the floodplain and wetlands may make it difficult to site on-site systems on several of the parcels in this needs area.

Land Use, Zoning, & Lot Sizing: The projected future wastewater flow for the Wings Cove/ Piney Point area is based on the zoning characteristics of the area as show in Figure 4-8 and Table 4-7. The needs area is zoned residential. An average parcel size of approximately 1.8 acres is, in general, sufficiently large enough for siting on-site systems. Similarly, the zoning and land use are not expected to pose challenges to the use of on-site systems in the future. Based on zoning, the projected average day flow is estimated to be 32,300 GPD for all parcels either already developed or able to be developed in the future.

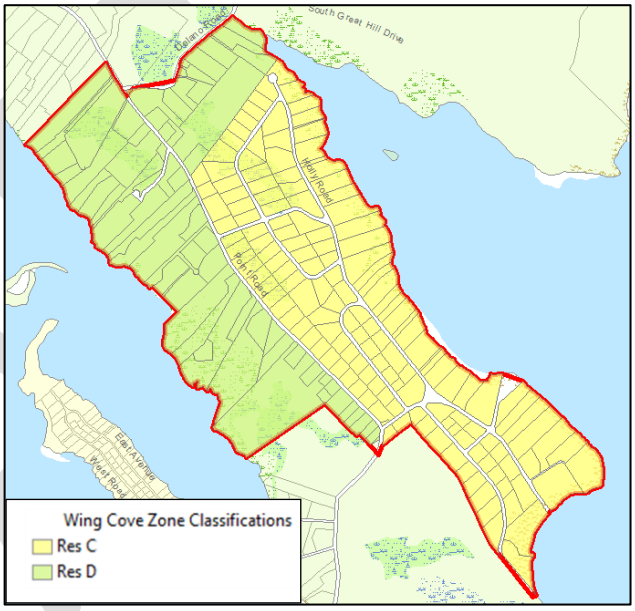

Figure 4-8: Wings Cove / Piney Point Needs Area Zoning Map

Table 4-7: Projected Sanitary Flow – Wings Cove/ Piney Point Area

Zoning District	% of Land Area	Number of Lot Connections	Flow Rate Per Lot - Max Day (GPD)	Projected Max Day Flow (GPD)	Projected Average Day Flow (GPD)[2]
Residence C	68	196	330[1]	64,700	32,300
Residence D	32				
			Total Future Flow Projection	**64,700**	**32,300**

[1] Assumes 3 Bedrooms Per Lot, Multiplied by 110 GPD Per Bedroom
[2] Assumes Average Day Flow = 1/2 * Max Day Flow

Nitrogen Loading: Parcels to the east of the needs area border Wings Cove; parcels to the west border Blankenship and Planting Island Coves which outlet to Outer Sippican Harbor. While none of these areas have known impairments, continued protection of water quality of the Inner Wing's Cove sub-embayment is important. If sewer is not extended to the Wings Cove/ Piney Point needs area, it is expected that this needs area would contribute 6.9 lb/day – 10.8 lb/day of total nitrogen to the Wings

Cove and Outer Sippican Harbor, based on a total future flow projection of 32,300 GPD. The precise ratio of nitrogen which contributes to either receiving water is unknown but is assumed to be approximately 1:1. Due to the large number of developed parcels, this needs area contributes the largest amount of nitrogen to the Buzzards Bay than any other needs area studied. Though neither of this needs area's receiving waters is impaired for nitrogen, reducing nitrogen and improving water quality in the whole of Buzzard's Bay remains a priority. Thus, the continued, high contribution of nitrogen from on-site systems in this area presents a challenge to the continued use of on-site systems here.

Soil Characteristics: Soils in this area are a mix of well draining, moderately draining, and poorly or very poorly draining soils, as shown in Figure 4-9 and Table 4-8. Combined with the prevalence of wetland areas and the location of the floodplain, the poorly and very poorly draining soils may present a challenge to siting fully compliant septic systems in this needs area in the future.

Table 4-8: Soil Drainage Distribution for Wings Cove/ Piney Point Needs Area

Soil Description	% of Land Area
Well Draining	35
Moderately Draining	29
Poorly/ Very Poorly Draining	13
Beach/ Water	5

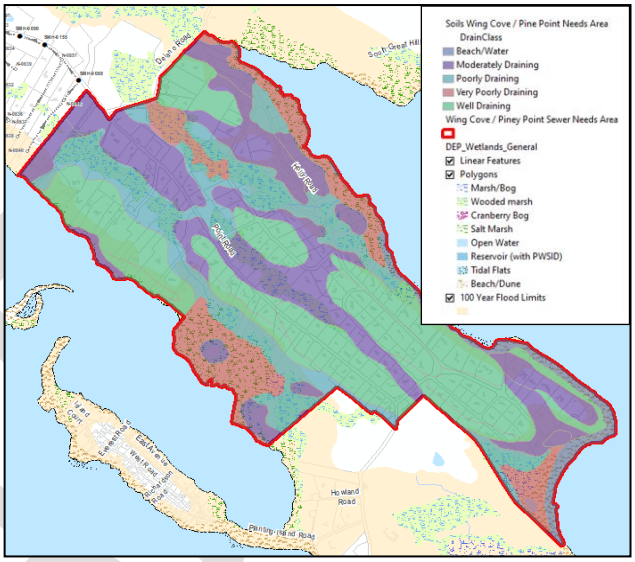

Figure 4-9: Wings Cove / Piney Point Needs Area Soils Profile

Water Supply Protection: There are no known DEP water resource areas Zone A, IWPAs, Wetland Protection Zone 1, DEP Approved Zone 2, or Public Water Supply Wells near this needs area. Therefore, there are no known water supply concerns for this area.

Priority Conclusions: These criteria represent environmental constraints to development and on-site system siting in the needs area. While continued use of on-site systems is possible for this area, a net reduction in nitrogen loading would require installation of enhanced on-site systems. With no change to the current regulations, these upgrades are required under certain circumstances; however, it is difficult to predict the timeline of required upgrades. The location and prevalence of poorly draining soils, wetlands, and floodplain may challenge the ability to site new or upgraded systems that are able to achieve full compliance. Therefore, this area is assigned a moderate priority for off-site treatment and disposal, due mainly to its proximity to several waterbodies and the potential for nitrogen contribution to those resources, if this area remains on-site.

4.1.2.4 Lower Sippican Neck Needs Area

The Lower Sippican Neckneeds area is located along Point Road near Howland Road, making up the southern boundary of the peninsula along through which Point Road runs. Figure 4-10 shows the extent of the Lower Sippican Neck needs area.

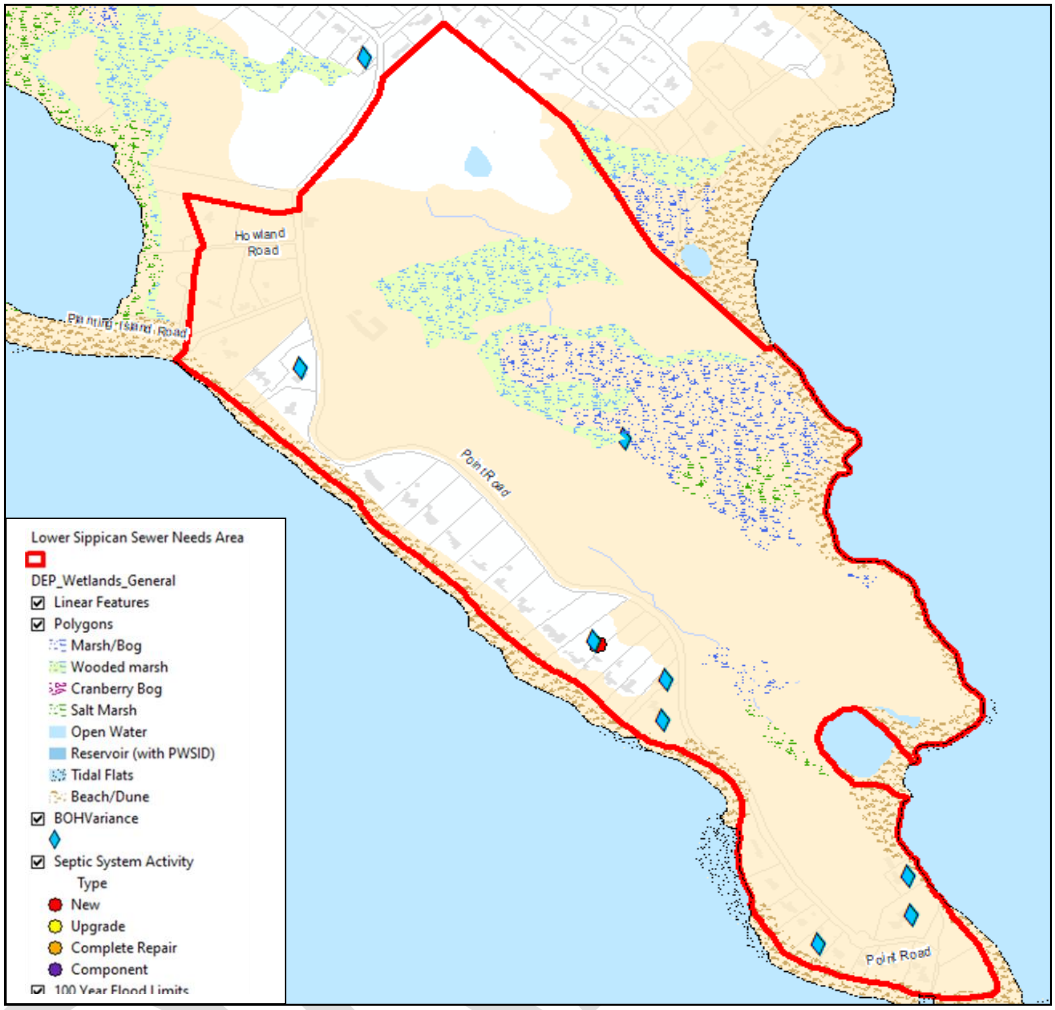

Figure 4-10: Lower Sippican Neck Needs Area

The area is currently served by private on-site systems including approximately 39 parcels, 38 of which have been determined to be potential sewer connections. The parcels of this needs area are characterized as follows:

39 Total Parcel Lots

- 36 Parcel Lots with Existing Buildings
  - Average lot size is 1.50 acres[7]
  - Average age of home (and likely septic system) is 68 years
  - 1 New Septic System Documented over the last 20 years
- 3 Vacant Parcel Lots
  - 2 Developable Vacant Parcel Lots (based on current zoning)
- 7 Parcel Lots Have Been Granted Board of Health Variances for On-Site Design Systems
- Wetlands and 100 Year Flood Plain Areas are Present Along Various Lots

[7] Lot sizes vary in the area, with individual lots generally ranging from approximately one half acre up to two acres.

Board of Health Records: At 68 years, the average age of the existing septic systems is beyond their 40-year life expectancy. As shown in Figure 4-10, seven parcels (21% of all parcels in the needs area) have been granted variances for on-site systems since 2000. This percentage of variances is higher compared to most other needs areas, indicating that there were challenges to fulfilling title 5 requirements for existing on-site systems in the past. Additionally, the average age of systems indicates that these systems may require increased frequency of repair or replacement in the future.

Wetlands & Floodplain Boundaries: Based on information shown in Figure 4-10, nearly all of the needs area lies within the 100-year floodplain. There are large swaths of wetlands, but they are mostly present only along the golf course. The floodplain location may make it difficult to site on-site systems on several of the parcels in this needs area, particularly those at the southern portion of the needs area.

Land Use, Zoning, & Lot Sizing: The projected future wastewater flow for the Lower Sippican Neck needs area is based on the zoning characteristics of the area as show in Figure 4-11 and Table 4-9. The needs area is zoned residential, though the largest parcel in this needs area, which encompasses more than half of the land area is made up of the Kittanset Golf Club. An average parcel size of approximately 1.5 acres is, in general, sufficiently large enough for siting on-site systems. Similarly, the zoning and land use are not expected to pose challenges to the use of on-site systems in the future. Based on zoning, the projected average day flow is estimated to be 6,300 GPD for all parcels either already developed or able to be developed in the future.

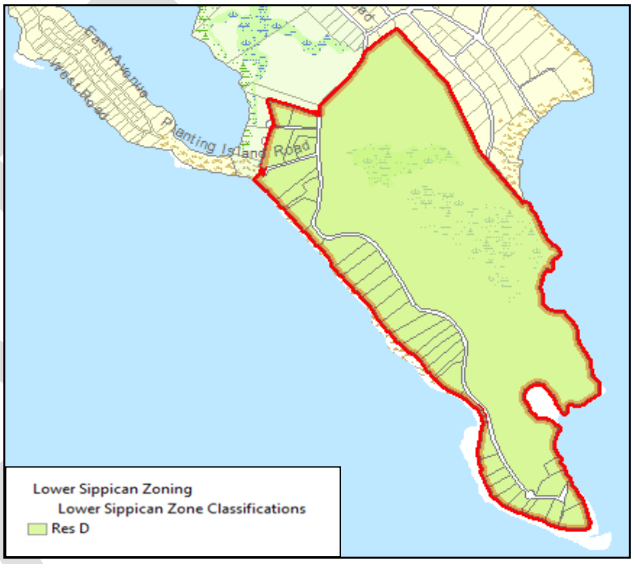

Figure 4-11: Lower Sippican Neck Needs Area Zoning Map

Table 4-9: Projected Sanitary Flow – Lower Sippican Neck Needs Area

Zoning District	% of Land Area	Number of Lot Connections	Flow Rate Per Lot - Max Day (GPD)	Projected Max Day Flow (GPD)	Projected Average Day Flow (GPD)[2]
Residence D	100	38	330[1]	12,500	6,300
			Total Future Flow Projection	**12,500**	**6,300**

[1] Assumes 3 Bedrooms Per Lot, Multiplied by 110 GPD Per Bedroom
[2] Assumes Average Day Flow = 1/2 * Max Day Flow

Nitrogen Loading: Parcels to the east of the needs area border Sedge Cove; parcels to the west border Outer Sippican Harbor. While none of these areas have known impairments, continued protection of water quality of the Outer Sippican Cove remains important. If sewer is not extended to the Lower Sippican Neck needs area, it is expected that this needs area would contribute 1.3 lb/day – 2.1 lb/day of total nitrogen to the Sedge Cove and Outer Sippican Harbor, based on a total future flow projection of 6,300 GPD. The precise ratio of nitrogen which contributes to either receiving water is unknown but is assumed to weigh heavily towards Outer Sippican Harbor. Though neither of this needs area's receiving waters is impaired for nitrogen, reducing nitrogen and improving water quality in the whole of

Buzzard's Bay remains a priority. Thus, the continued contribution of nitrogen from on-site systems in this area presents a challenge to the continued use of on-site systems here.

Soil Characteristics: Soils in this area are a mix of well draining, moderately draining, and poorly or very poorly draining soils, as shown in Figure 4-12 and Table 4-10. However, most parcels that are not the golf course have well or moderately draining soils. Therefore, the drainage characteristics of the soils in this needs area are not expected to be a challenge to siting fully compliant septic systems in this needs area in the future.

Table 4-10: Soil Drainage Distribution for Lower Sippican Neck Needs Area

Soil Description	% of Land Area
Well Draining	7
Moderately Draining	48
Poorly/ Very Poorly Draining	39
Beach/ Water	6

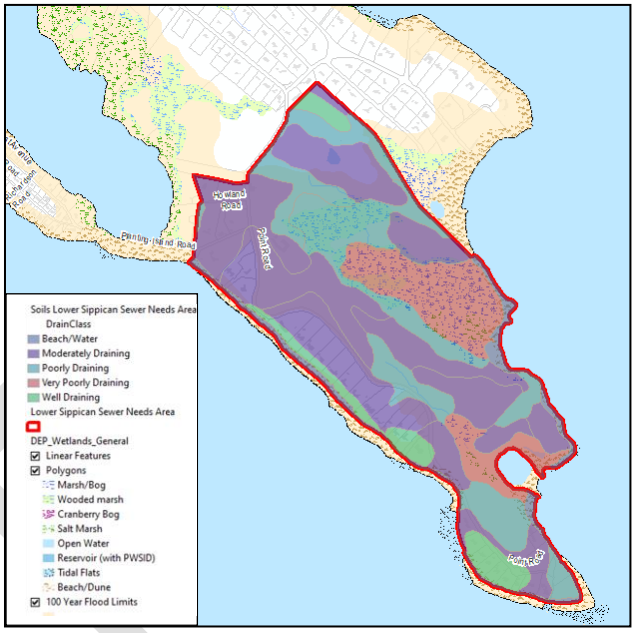

Figure 4-12: Lower Sippican Neck Needs Area Soils Profile

Water Supply Protection: There are no known DEP water resource areas Zone A, IWPAs, Wetland Protection Zone 1, DEP Approved Zone 2, or Public Water Supply Wells near this needs area. Therefore, there are no known water supply concerns for this area.

Priority Conclusions: These criteria represent environmental constraints to development and on-site system siting in the needs area. Continued use of on-site systems poses significant challenges; a net reduction in nitrogen loading would require installation of enhanced on-site systems. With no change to the current regulations, these upgrades are required under certain circumstances; however, it is difficult to predict the timeline of required upgrades. The high percentage of variances in the area indicate that even new or upgraded systems may not be able to achieve full compliance. Therefore, this area is assigned a high priority for off-site treatment and disposal, due also to its proximity to Sedge Cove and Outer Sippican Harbor and the potential for nitrogen contribution to those resources, if on-site systems remain.

4.1.2.5 Planting Island Needs Area

The Planting Island needs area is located along East Avenue and West Avenue. Figure 4-13 shows the extents of the Planting Island needs area.

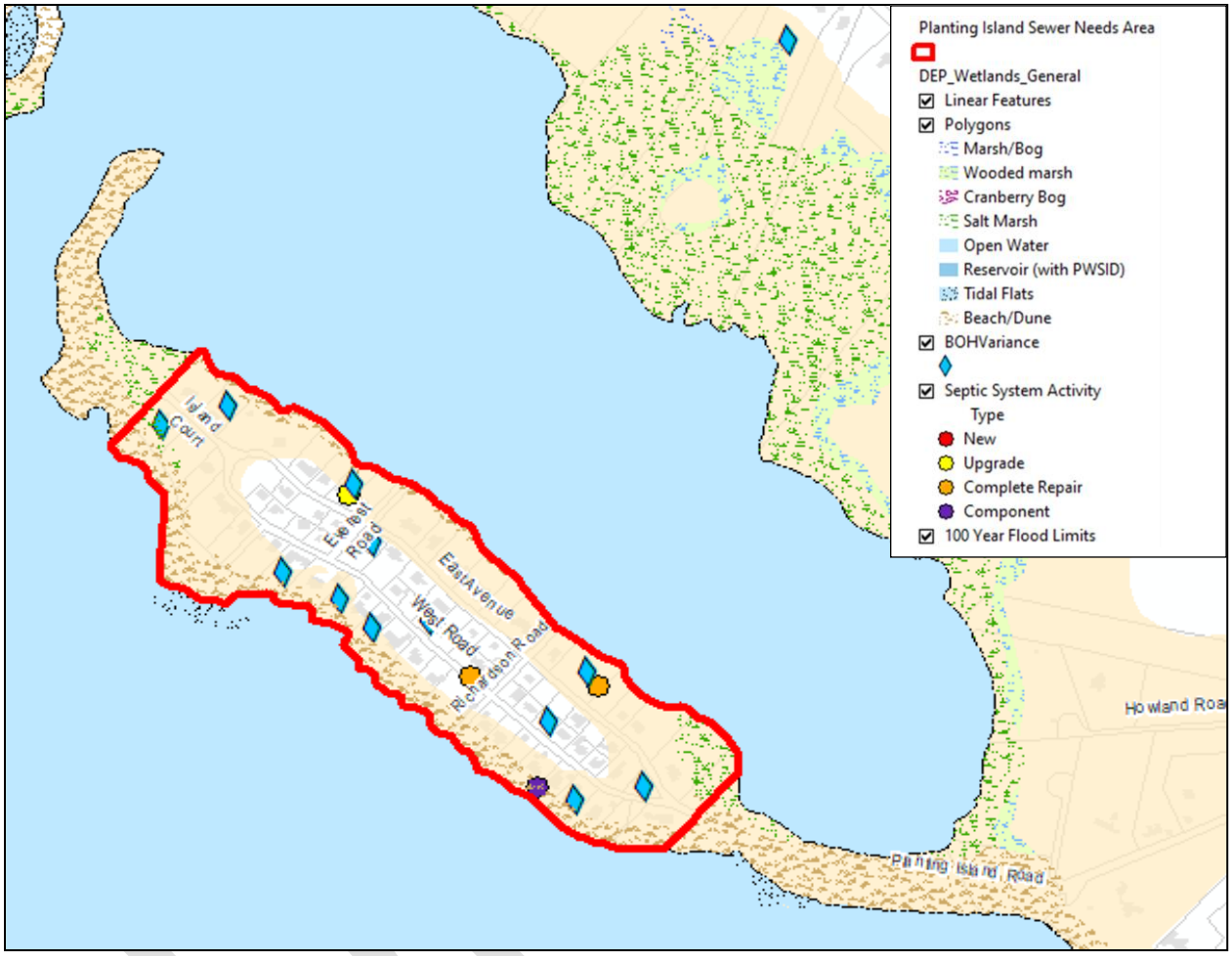

Figure 4-13: Planting Island Needs Area

The area is currently served by private on-site systems including approximately 80 parcels, 79 of which have been determined to be potential sewer connections. The parcels of this needs area are characterized as follows:

80 Total Parcel Lots

- 75 Parcel Lots with Existing Buildings
  - Average lot size is 0.33 acres
  - Average age of home (and likely septic system) is 60 years
  - 1 Septic System Upgrade, 2 Septic System Repairs Documented over the last 20 years
- 5 Vacant Parcel Lots
  - 4 Developable Vacant Parcel Lots (based on current zoning)
- 12 Parcel Lots Have Been Granted Board of Health Variances for On-Site Design Systems
- Wetlands and 100 Year Flood Plain Areas are Present Along Various Lots

Board of Health Records: At 60 years, the average age of the existing septic systems is beyond their 40-year life expectancy. As shown in Figure 4-13, twelve parcels (18% of all parcels in the needs area) have been granted variances for on-site systems since 2000. This percentage of variances is higher compared to most other needs areas, indicating that there were challenges to fulfilling title 5 requirements for existing on-site systems in the past. Additionally, the average age of systems indicates that these systems may require increased frequency of repair or replacement in the future.

Wetlands & Floodplain Boundaries: Based on information shown in Figure 4-13, 71% of the needs area lies within the 100-year floodplain. There is some beach land but not wetlands present in the needs area. The location of the floodplain may make it difficult to site on-site systems on several of the parcels in this needs area.

Land Use, Zoning, & Lot Sizing: The projected future wastewater flow for the Planting Island Needs Area is based on the zoning characteristics of the area as show in Figure 4-14 and Table 4-11. The needs area is zoned residential. An average parcel size of approximately 0.3 acres may pose a challenge to the siting of on-site systems. However, the zoning and land use are not expected to pose any additional challenges. Based on zoning, the projected average day flow is estimated to be 13,000 GPD for all parcels either already developed or able to be developed in the future.

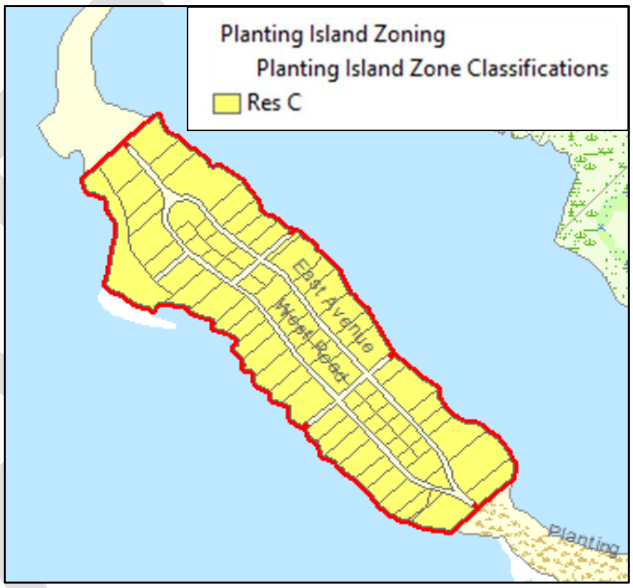

Figure 4-14: Planting Island Needs Area Zoning Map

Table 4-11: Projected Sanitary Flow – Planting Island Needs Area

Zoning District	% of Land Area	Number of Lot Connections	Flow Rate Per Lot - Max Day (GPD)	Projected Max Day Flow (GPD)	Projected Average Day Flow (GPD)[2]
Residence D	100	79	330[1]	26,000	13,000
			Total Future Flow Projection	**26,000**	**13,000**

[1] Assumes 3 Bedrooms Per Lot, Multiplied by 110 GPD Per Bedroom
[2] Assumes Average Day Flow = 1/2 * Max Day Flow

Nitrogen Loading: Planting Island is a peninsula that juts off the western side of Sippican Neck, bounded by Planting Island Cove to the east, and Outer Sippican Harbor to the west. While neither of these areas have known impairments, continued protection of their water quality remains important. If sewer is not extended to the Planting Island needs area, it is expected that this needs area would contribute 2.8 lb/day – 4.4 lb/day of total nitrogen to Planting Island Cove and Outer Sippican Harbor, based on a total future flow projection of 13,000 GPD. The precise ratio of nitrogen which contributes directly to either receiving water is unknown but is assumed to be approximately 1:1. Though neither of this needs area's receiving waters is impaired for nitrogen, reducing nitrogen, and improving water quality in the whole of

Buzzard's Bay remains a priority. Thus, the continued contribution of nitrogen from on-site systems in this area presents a challenge to the continued use of on-site systems here.

Soil Characteristics: Soils in this area are almost entirely excessively draining, as shown in Figure 4-15 and Table 4-12. Excessively draining soils pose a challenge to siting fully compliant septic systems in this needs area in the future.

Table 4-12: Soil Drainage Distribution for Planting Island Needs Area

Soil Description	% of Land Area
Excessively Draining	81
Poorly/ Very Poorly Draining	4
Beach/ Water	15

Figure 4-15: Planting Island Needs Area Soils Profile

Water Supply Protection: There are no known DEP water resource areas Zone A, IWPAs, Wetland Protection Zone 1, DEP Approved Zone 2, or Public Water Supply Wells near this needs area. Therefore, there are no known water supply concerns for this area.

Priority Conclusions: These criteria represent environmental constraints to development and on-site system siting in the needs area. Continued use of on-site systems for this area would be a significant challenge; a net reduction in nitrogen loading would require installation of enhanced on-site systems. With no change to the current regulations, these upgrades are required under certain circumstances; however, it is difficult to predict the timeline of required upgrades. The high percentage of variances in the area indicate that even new or upgraded systems may not be able to achieve full compliance. Additionally, the presence and location of floodplain, excessively draining soils and the surrounding Cove/Harbor pose further challenges. Therefore, this area is assigned a high priority for off-site treatment and disposal.

4.1.2.6 Allens Point/ Harbor East Needs Area

The Allens Point/ Harbor East needs area is located along Allens Point Road and West Drive. Figure 4-16 shows the extents of the Allens Point/ Harbor East needs area.

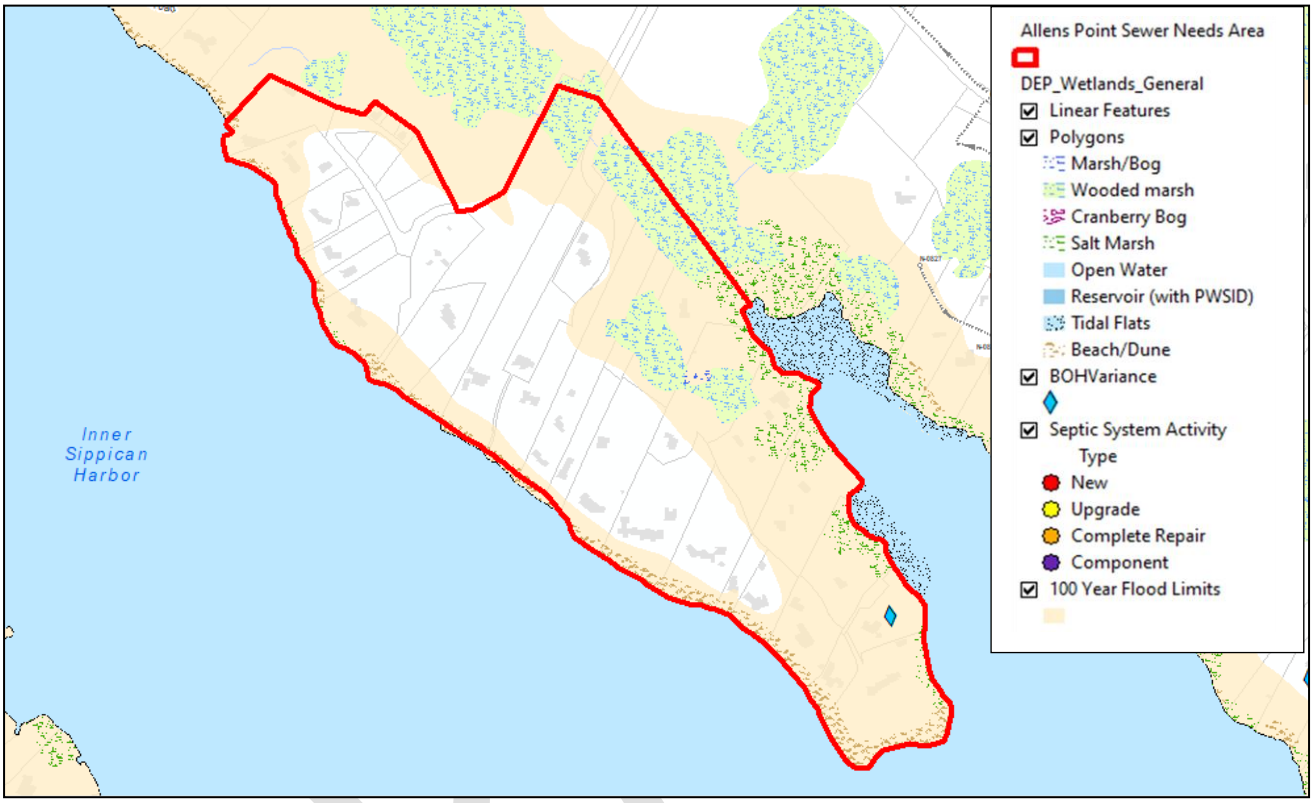

Figure 4-16: Allens Point/ Harbor East Needs Area

The area is currently served by private on-site systems including approximately 35 parcels, 34 of which have been determined to be potential sewer connections. The parcels of this needs area are characterized as follows:

35 Total Parcel Lots

- 29 Parcel Lots with Existing Buildings
  - Average lot size is 2.43 acres
  - Average age of home (and likely septic system) is 86 years
- 6 Vacant Parcel Lots
  - 5 Developable Vacant Parcel Lots (based on current zoning)
- 1 Parcel Lot Has Been Granted Board of Health Variances for On-Site Design Systems
- Wetlands and 100 Year Flood Plain Areas are Present Along Various Lots

Board of Health Records: At 86 years, the average age of the existing septic systems is more than double their 40-year life expectancy. As shown in Figure 4-16, one parcel (3% of all parcels in the needs area) was granted a variance for an on-site system since 2000. This single variance indicates that there has not been significant nor consistent known challenges to fulfilling title 5 requirements for existing on-

site systems in the needs area. However, the average age of systems indicates that these systems may require increased frequency of repair or replacement in the future.

Wetlands & Floodplain Boundaries: Based on information shown in Figure 4-16, 57% of the needs area lies within the 100-year floodplain. There are some wetlands, but they are present in locations that would add difficulty to siting on-site systems. The location of floodplain may make it difficult to site on-site systems on several of the parcels in this needs area, particularly those at the southern and eastern portions of the needs area.

Land Use, Zoning, & Lot Sizing: The projected future wastewater flow for the Allens Point/ Harbor East Needs Area is based on the zoning characteristics of the area as shown in Figure 4-17 and Table 4-13. The needs area is zoned residential. An average parcel size of approximately 2.4 acres is, in general, sufficiently large enough for siting on-site systems. Similarly, the zoning and land use are not expected to pose challenges to the use of on-site systems in the future. Based on zoning, the projected average day flow is estimated to be 5,600 GPD for all parcels either already developed or able to be developed in the future.

Figure 4-17: Allens Point/ Habor East Needs Area Zoning Map

Table 4-13: Projected Sanitary Flow – Allens Point/ Harbor East Needs Area

Zoning District	% of Land Area	Number of Lot Connections	Flow Rate Per Lot - Max Day (GPD)	Projected Max Day Flow (GPD)	Projected Average Day Flow (GPD)[2]
Residence D	100	34	330[1]	11,000	5,600
			Total Future Flow Projection	**11,000**	**5,600**

[1] Assumes 3 Bedrooms Per Lot, Multiplied by 110 GPD Per Bedroom
[2] Assumes Average Day Flow = 1/2 * Max Day Flow

Nitrogen Loading: The Allens Point/ Harbor East needs area is bordered by Blankenship Cove to the southeast and the Inner Sippican Harbor to the west. The Inner Sippican Harbor has numerous known impairments, including one for total nitrogen. Blankenship Harbor does not have any known impairments, but its water quality has been monitored by the BBC since 1993 and has been found to have a rating of good on the BBC's Bay Health Index. Figure 1-6 (attached) shows impaired water bodies. If no action is taken, it is expected that this needs area would contribute 1.2 lb/day – 1.8 lb/day of total nitrogen to Blankenship Cove and Inner Sippican Harbor, based on a total future flow projection of 5,600 GPD. The precise ratio of nitrogen which contributes directly to either receiving water is unknown but is assumed to weigh heavily towards Inner Sippican Harbor. Reducing nitrogen load to the Inner Sippican Harbor and Buzzards Bay as a whole is a high priority and thus the continued, high contribution of nitrogen from on-site systems in this area presents a challenge to the continued use of on-site systems here.

Soil Characteristics: Soils in this area are primarily well or moderately draining, as shown in Figure 4-18 and Table 4-14. However, a portion of parcels on the northern end of the needs area have excessively draining soils and abut the Inner Sippican Harbor. For these parcels, siting fully compliant septic systems in this needs area may be a challenge in the future.

Table 4-14: Soil Drainage Distribution for Allens Point/ Harbor East Needs Area

Soil Description	% of Land Area
Excessively Draining	14
Well Draining	51
Moderately Draining	21
Poorly/ Very Poorly Draining	11
Beach/ Water	3

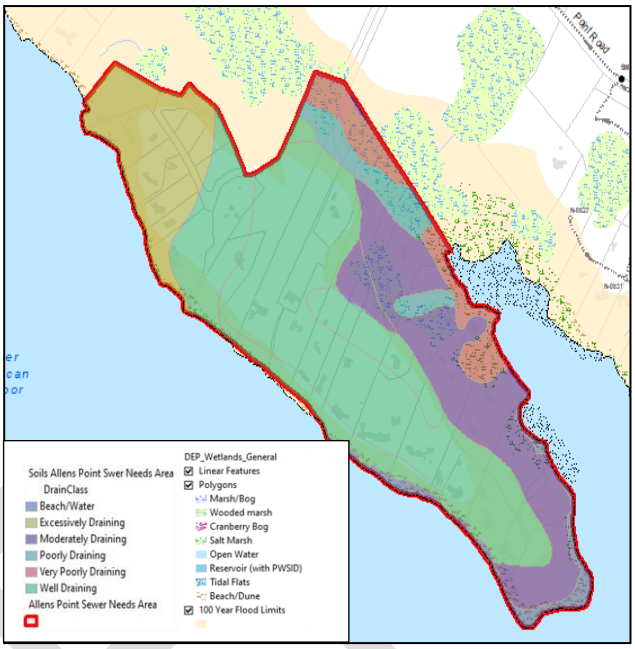

Figure 4-18: Allens Point/ Harbor East Needs Area Soils Profile

Water Supply Protection: There are no known DEP water resource areas Zone A, IWPAs, Wetland Protection Zone 1, DEP Approved Zone 2, or Public Water Supply Wells near this needs area. Therefore, there are no known water supply concerns for this area.

Priority Conclusions: These criteria represent environmental constraints to development and on-site system siting in the needs area. While continued use of on-site systems is possible for this area, a net reduction in nitrogen loading would require installation of enhanced on-site systems. With no change to the current regulations, these upgrades are required under certain circumstances; however, it is difficult to predict the timeline of required upgrades. The average age indicates that these systems may require increased frequency of repair or replacement in the future, and the location of excessively draining soils may challenge the ability to site new or upgraded systems that are able to achieve full compliance. However, with a relatively low percentage of past variances and larger lot sizes than other needs areas, these challenges can likely be overcome to allow for use of enhanced on-site systems. Therefore, this area is assigned a lower priority for off-site treatment and disposal.

4.1.2.7 Converse Point Needs Area

The Converse Point needs area is located along Converse Road, forming the tip of the peninsula at which Moorings Road truncates. Figure 4-19 shows the extents of the Converse Point needs area.

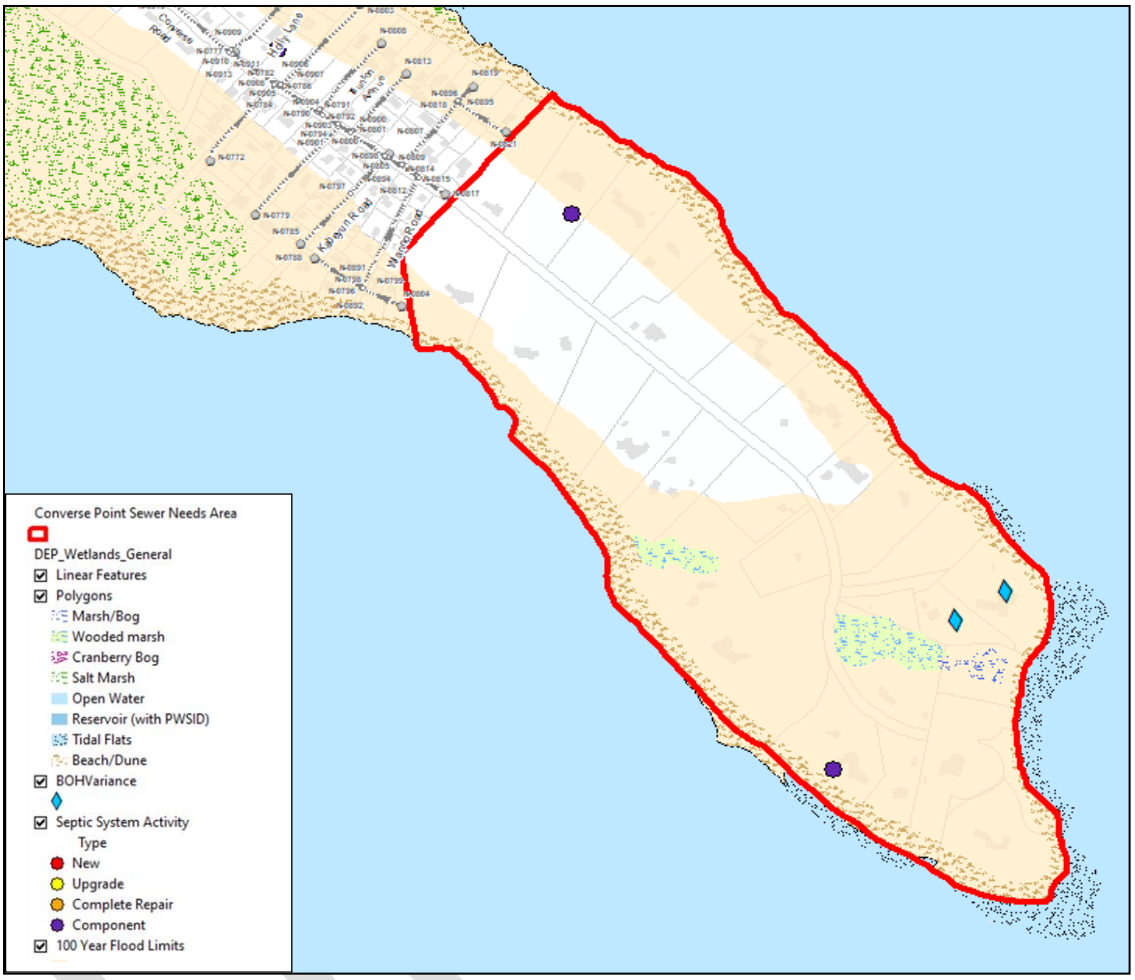

Figure 4-19: Converse Point Needs Area

The area is currently served by private on-site systems including approximately 27 parcels, 26 of which have been determined to be potential sewer connections. The parcels of this needs area are characterized as follows:

27 Total Parcel Lots

- 23 Parcel Lots with Existing Buildings
  - Average lot size is 2.60 acres
  - Average age of home (and likely septic system) is 55 years
- 4 Vacant Parcel Lots
  - 3 Developable Vacant Parcel Lots (based on current zoning)
- 2 Parcel Lots Have Been Granted Board of Health Variances for On-Site Design Systems
- Wetlands and 100 Year Flood Plain Areas are Present Along Various Lots

Board of Health Records: At 55 years, the average age of the existing septic systems is beyond their 40-year life expectancy. As shown in Figure 4-19, two parcels (9% of all parcels in the needs area) have been granted variances for on-site systems since 2000. This number of variances indicates that there has not been significant nor consistent known challenges to fulfilling title 5 requirements for existing on-site systems in the needs area. However, the average age of systems indicates that these systems may require increased frequency of repair or replacement in the future.

Wetlands & Floodplain Boundaries: Based on information shown in Figure 4-19, 72% of the needs area lies within the 100-year floodplain. There is some beach land but minimal wetlands present in the needs area. The location of the floodplain may make it difficult to site on-site systems on several of the parcels in this needs area, particularly those at the southern end of the peninsula.

Land Use, Zoning, & Lot Sizing: The projected future wastewater flow for the Converse Point needs area is based on the zoning characteristics of the area as show in Figure 4-20 and Table 4-15. The needs area is zoned residential. An average parcel size of approximately 2.6 acres is, in general, sufficiently large enough for siting on-site systems. Similarly, the zoning and land use are not expected to pose challenges to the use of on-site systems in the future. Based on zoning, the projected average day flow is estimated to be 4,300 GPD for all parcels either already developed or able to be developed in the future.

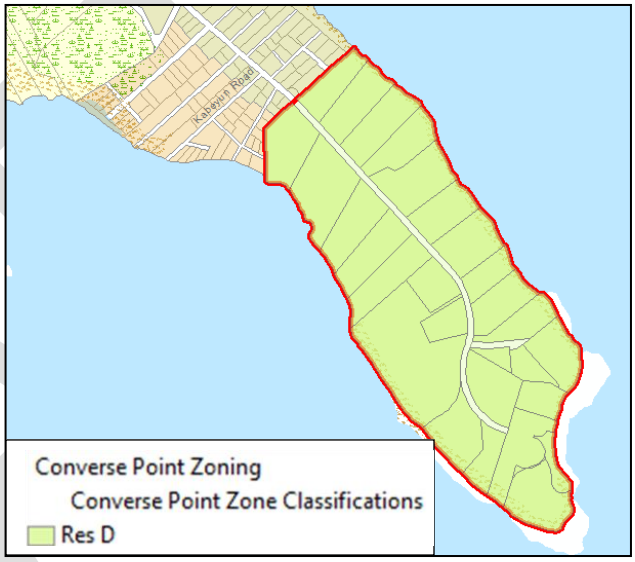

Figure 4-20: Converse Point Needs Area Zoning Map

Table 4-15: Projected Sanitary Flow – Converse Point Needs Area

Zoning District	% of Land Area	Number of Lot Connections	Flow Rate Per Lot - Max Day (GPD)	Projected Max Day Flow (GPD)	Projected Average Day Flow (GPD)[2]
Residence D	100	26	330[1]	8,600	4,300
			Total Future Flow Projection	**8,600**	**4,300**

[1] Assumes 3 Bedrooms Per Lot, Multiplied by 110 GPD Per Bedroom
[2] Assumes Average Day Flow = 1/2 * Max Day Flow

Nitrogen Loading: The Converse Point Needs Area is bordered by the Outer Sippican Harbor to the east and Outer Aucoot Cove to the west; neither water body segments have known impairments or reported water health issues. If no action is taken in the Converse Point needs area, it is expected that this needs area would contribute 0.9 lb/day – 1.4 lb/day of total nitrogen to the Outer Sippican Harbor and Outer Aucoot Cove, based on a total future flow projection of 4,300 GPD. The precise ratio of nitrogen which contributes directly to either receiving water is unknown but is assumed to be approximately 1:1. Though neither of this needs area's receiving waters is impaired for nitrogen, reducing nitrogen and improving water quality in the whole of Buzzard's Bay remains a priority. Thus, the continued contribution of

nitrogen from on-site systems in this area presents a challenge to the continued use of on-site systems here.

Soil Characteristics: Soils in this area are primarily moderately well draining, as shown in Figure 4-21 and Table 4-16. Therefore, the drainage characteristics of the soils in this needs area are not expected to be a challenge to siting fully compliant septic systems in this needs area in the future.

Table 4-16: Soil Drainage Distribution for Converse Point Needs Area

Soil Description	% of Land Area
Moderately Draining	81
Poorly Draining	6
Beach/ Water	13

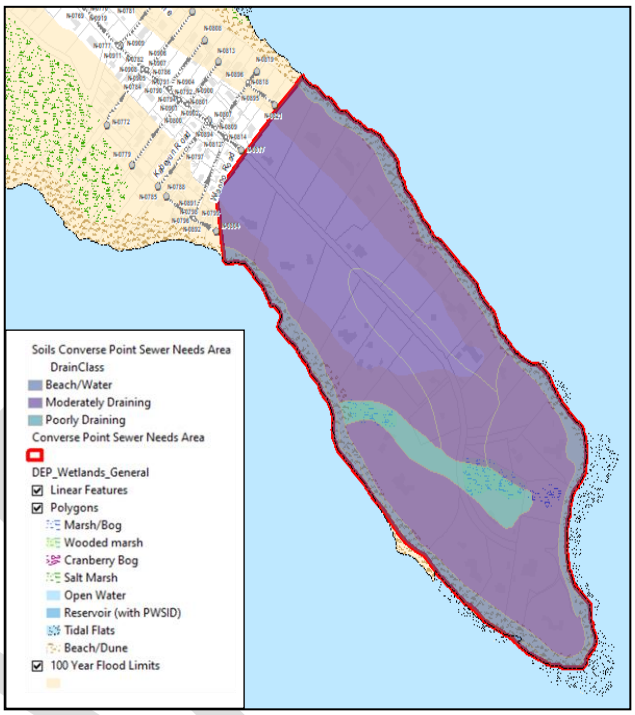

Figure 4-21: Converse Point Needs Area Soils Profile

Water Supply Protection: There are no known DEP water resource areas Zone A, IWPAs, Wetland Protection Zone 1, DEP Approved Zone 2, or Public Water Supply Wells near this needs area. Therefore, there are no known water supply concerns for this area.

Priority Conclusions: These criteria represent environmental constraints to development and on-site system siting in the needs area. While continued use of on-site systems is possible for this area, a net reduction in nitrogen loading would require installation of enhanced on-site systems. With no change to the current regulations, these upgrades are required under certain circumstances; however, it is difficult to predict the timeline of required upgrades. The average age indicates that these systems may require increased frequency of repair or replacement in the future, however with a relatively low percentage of past variances and larger lot sizes than other needs areas, these challenges can likely be overcome to allow for use of enhanced on-site systems. Therefore, this area is assigned a lower priority for off-site treatment and disposal.

4.1.2.8 Aucoot Creek Needs Area

The Aucoot Creek sewer needs area is located along Mill Street near Indian Cove Road, ending at the Town boundary with Mattapoisett. Figure 4-22 shows the extents of the Aucoot Creek needs area.

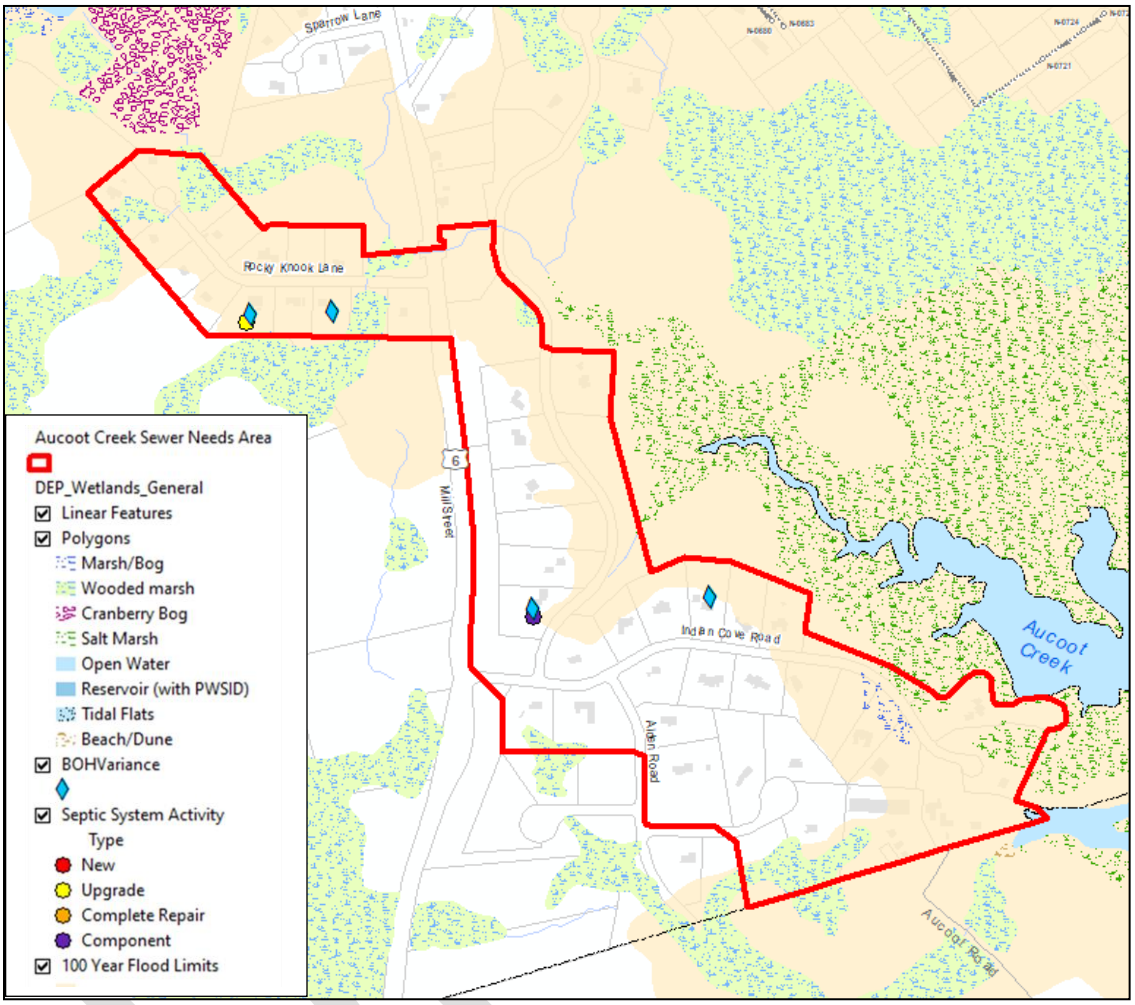

Figure 4-22: Aucoot Creek Needs Area

The area is currently served by private on-site systems including approximately 52 parcels, 44 of which have been determined to be potential sewer connections. The parcels of this needs area are characterized as follows:

52 Total Parcel Lots

- 41 Parcel Lots with Existing Buildings
  - Average lot size is 1.40 acres
  - Average age of home (and likely septic system) is 36 years
  - 1 Septic System Upgrade Documented over the last 20 years
- 11 Vacant Parcel Lots
  - 3 Developable Vacant Parcel Lots (based on current zoning)
- 4 Parcel Lots Have Been Granted Board of Health Variances for On-Site Design Systems
- Wetlands and 100 Year Flood Plain Areas are Present Along Various Lots

Board of Health Records: At 36 years, the average age of the existing septic systems is approaching their 40-year life expectancy. As shown in Figure 4-22, four parcels (9% of all parcels in the needs area) have been granted variances for on-site systems since 2000. This number of variances indicates that there has not been significant nor consistent known challenges to fulfilling title 5 requirements for existing on-site systems in the needs area. However, the average age of systems indicates that these systems may require increased frequency of repair or replacement in the future.

Wetlands & Floodplain Boundaries: Based on information shown in Figure 4-22, 59% of the needs area lies within the 100-year floodplain. There are minimal wetlands present in the needs area. The location of the floodplain may make it difficult to site on-site systems on several of the parcels in this needs area, particularly those along Rocky Knook Lane and at the end of Indian Cove Road

Land Use, Zoning, & Lot Sizing: The projected future sanitary flow for the Aucoot Creek needs area is based on the zoning characteristics of the area as show in Figure 4-23 and Table 4-17. The needs area is zoned residential. An average parcel size of approximately 1.4 acres is, in general, sufficiently large enough for siting on-site systems. Similarly, the zoning and land use are not expected to pose challenges to the use of on-site systems in the future. Based on zoning, the projected average day flow is estimated to be 7,300 GPD for all parcels either already developed or able to be developed in the future.

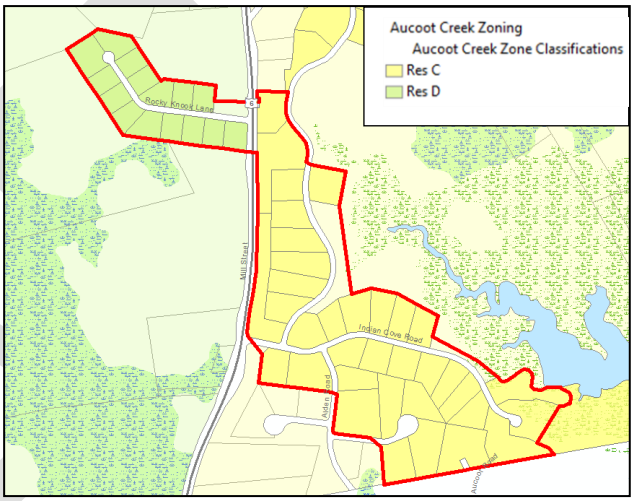

Figure 4-23: Aucoot Creek Needs Area Zoning Map

Table 4-17: Projected Sanitary Flow – Aucoot Creek Needs Area

Zoning District	% of Land Area	Number of Lot Connections	Flow Rate Per Lot - Max Day (GPD)	Projected Max Day Flow (GPD)	Projected Average Day Flow (GPD)[2]
Residence C	73	44	330[1]	14,500	7,300
Residence D	27				
			Total Future Flow Projection	**14,500**	**7,300**

[1] Assumes 3 Bedrooms Per Lot, Multiplied by 110 GPD Per Bedroom
[2] Assumes Average Day Flow = 1/2 * Max Day Flow

Nitrogen Loading: The parcels on the eastern edge of the needs area are adjacent to Aucoot Creek and surrounding wetlands. Aucoot Creek has numerous impairments, including total nitrogen. Aucoot Creek is also a downstream receiving water for the WPCF's treated effluent. Figure 1-6 (attached) shows impaired water bodies. If no action is taken in the Aucoot Creek needs area, it is expected that this needs area would contribute 1.5 lb/day – 2.4 lb/day of total nitrogen to Aucoot Creek, based on a total future flow projection of 7,300 GPD. Thus, the continued contribution of nitrogen from on-site systems in this area presents a challenge to the continued use of on-site systems here.

Soil Characteristics: Soils in this area are a mix of well draining, moderately draining, and poorly or very poorly draining soils, as shown in Figure 4-24 and Table 4-18. Combined with the location of the floodplain, the poorly and very poorly draining soils may present a challenge to siting fully compliant septic systems in this needs area in the future.

Table 4-18: Soil Drainage Distribution for Aucoot Creek Needs Area

Soil Description	% of Land Area
Well Draining	32
Moderately Draining	37
Poorly/ Very Poorly Draining	31
Beach/ Water	<1

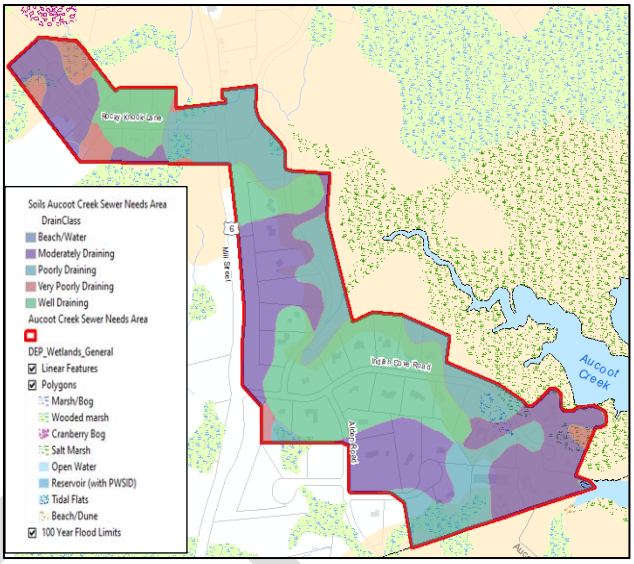

Figure 4-24: Aucoot Creek Needs Area Soils Profile

Water Supply Protection: There are no known DEP water resource areas Zone A, IWPAs, Wetland Protection Zone 1, DEP Approved Zone 2, or Public Water Supply Wells near this needs area. Therefore, there are no known water supply concerns for this area.

Priority Conclusions: These criteria represent environmental constraints to development and on-site system siting in the needs area. Continued use of on-site systems poses a significant challenge to this area; a net reduction in nitrogen loading would require installation of enhanced on-site systems. With no change to the current regulations, these upgrades are required under certain circumstances; however, it is difficult to predict the timeline of required upgrades. The location the floodplain and the moderate presence of poorly draining soils challenge the ability to site new or upgraded systems that can achieve full compliance. Therefore, this area is assigned a high priority for treatment and disposal, due mainly to its proximity to the Outer Sippican Harbor and Outer Aucoot Cove and the potential for nitrogen contribution to those resources.

4.1.2.9 Lower Mill Street Needs Area

The Lower Mill Street sewer needs area is located along Mill Street between Parlowtown Road and Sparrow Lane, directly north of the Aucoot Creek needs area. Figure 4-25 shows the extents of the Lower Mill Street needs area. While this area is not served by the Town sewer system, the route of the WPCF outfall passes through the middle of the needs area.

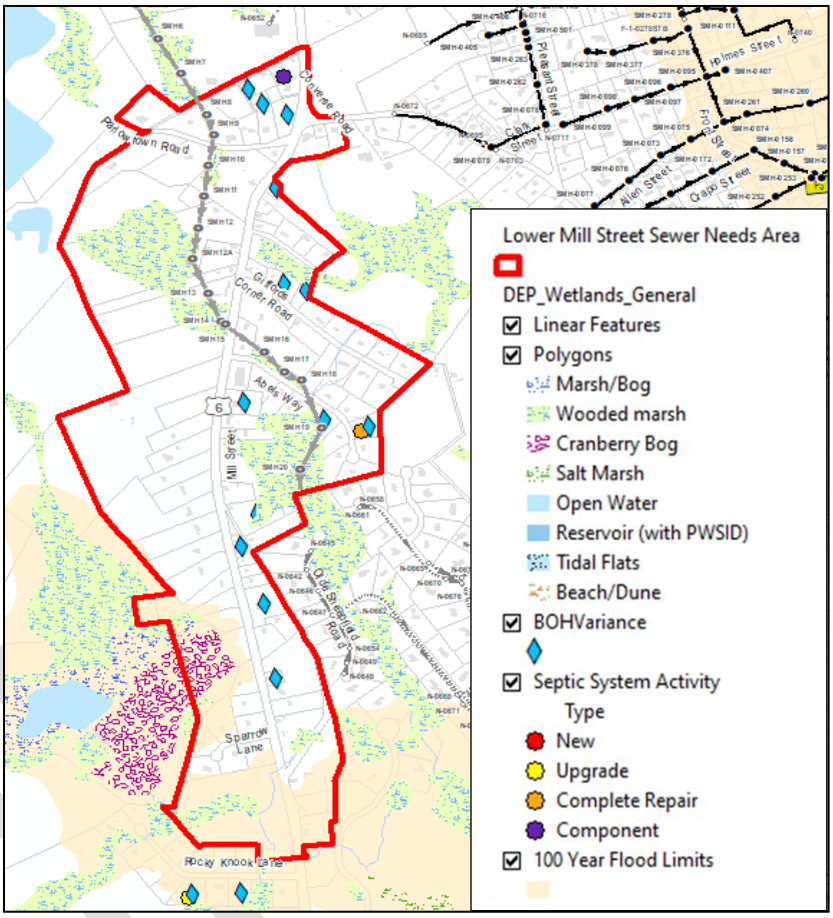

Figure 4-25: Lower Mill Street Needs Area

The area is currently served by private on-site systems including approximately 116 parcels, 111 of which have been determined to be potential sewer connections. The parcels of this needs area are characterized as follows:

116 Total Parcel Lots

- 104 Parcel Lots with Existing Buildings
  - Average lot size is 1.30 acres
  - Average age of home (and likely septic system) is 54 years
  - 1 Septic System Repair Documented over the last 20 years
- 12 Vacant Parcel Lots
  - 7 Developable Vacant Parcel Lots (based on current zoning)
- 13 Parcel Lots Have Been Granted Board of Health Variances for On-Site Design Systems
- Wetlands and 100 Year Flood Plain Areas are Present Along Various Lots

Board of Health Records: At 54 years, the average age of the existing septic systems is beyond their 40-year life expectancy. As shown in Figure 4-25, thirteen parcels (13% of all parcels in the needs area) have been granted variances for on-site systems since 2000. This number of variances indicates that there has not been significant nor consistent known challenges to fulfilling title 5 requirements for existing on-site systems in the needs area. However, the average age of systems indicates that these systems may require increased frequency of repair or replacement in the future.

Wetlands & Floodplain Boundaries: Based on information shown in Figure 4-25, 14% of the needs area lies within the 100-year floodplain. There are a number of wetlands present in the needs area. The limited floodplain and wetlands pose limited challenges to siting on-site systems in this needs area.

Land Use, Zoning, & Lot Sizing: The projected future wastewater flow for the Lower Mill Street Needs Area is based on the zoning characteristics of the area as shown in Figure 4-26 and Table 4-19. The needs area is zoned residential. An average parcel size of approximately 1.3 acres is, in general, sufficiently large enough for siting on-site systems. Similarly, the zoning and land use are not expected to pose challenges to the use of on-site systems in the future. Based on zoning, the projected average day flow is estimated to be 18,300 GPD for all parcels either already developed or able to be developed in the future.

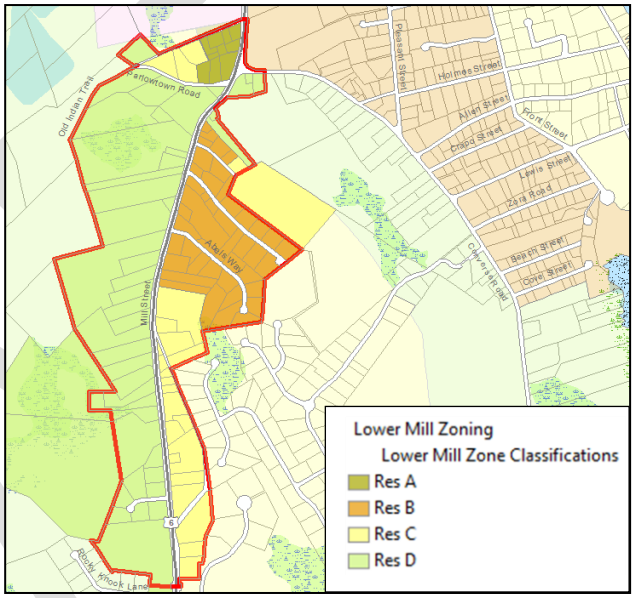

Figure 4-26: Lower Mill Street Needs Area Zoning Map

Table 4-19: Projected Sanitary Flow – Lower Mill Street Needs Area

Zoning District	% of Land Area	Number of Lot Connections	Flow Rate Per Lot - Max Day (GPD)	Projected Max Day Flow (GPD)	Projected Average Day Flow (GPD)[2]
Residence A	8	111	330[1]	36,600	18,300
Residence B	36				
Residence C	20				
Residence D	36				
			Total Future Flow Projection	**36,600**	**18,300**

[1] Assumes 3 Bedrooms Per Lot, Multiplied by 110 GPD Per Bedroom
[2] Assumes Average Day Flow = 1/2 * Max Day Flow

Nitrogen Loading: The Lower Mill Street needs area does not border any surface waters. If no action is taken in the Lower Mill Street needs area, it is expected that this needs area would contribute 3.9 lb/day – 6.2 lb/day of total nitrogen based on a total future flow projection of 18,300 GPD.

Soil Characteristics: Soils in this area are a mix of well draining, moderately draining, and poorly or very poorly draining soils, as shown in Figure 4-24 and Table 4-18. Combined with the location of the floodplain, the poorly and very poorly draining soils may present a challenge to siting fully compliant septic systems in this needs area in the future.

Soils in this area consist of a mix of moderately and well draining, as shown in Figure 4-27 and Table 4-20. Approximately 14% of the area lies within the 100-year floodplain.

Soil Characteristics: Soils in this area are a mix of well draining, moderately draining, and poorly or very poorly draining soils, as shown in Figure 4-27 and Table 4-20. The poorly and very poorly draining soils may present a challenge to siting fully compliant septic systems in this needs area in the future.

Table 4-20: Soil Drainage Distribution for Lower Mill Street Needs Area

Soil Description	% of Land Area
Well Draining	19
Moderately Draining	51
Poorly/ Very Poorly Draining	30

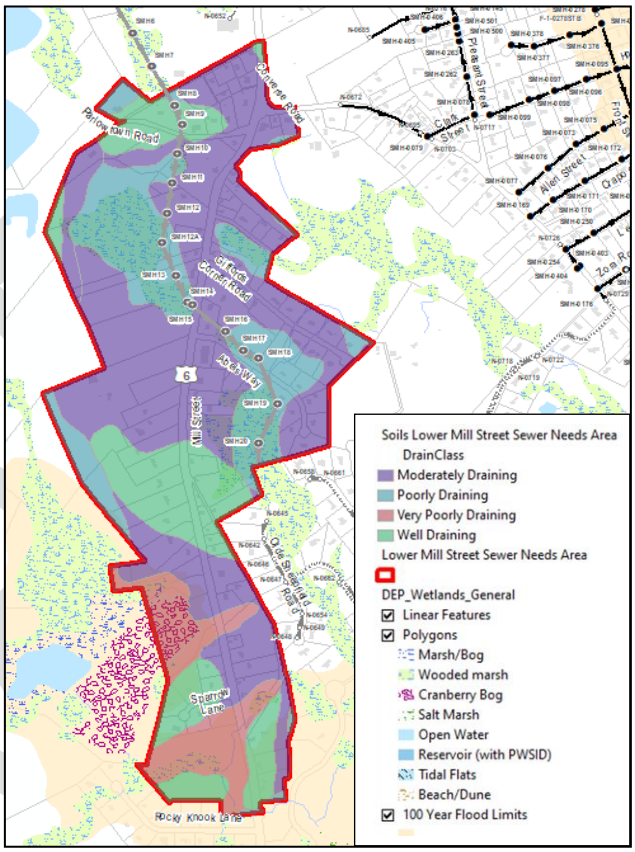

Figure 4-27: Lower Mill Street Needs Area Soils Profile

Water Supply Protection: There are no known DEP water resource areas Zone A, IWPAs, Wetland Protection Zone 1, DEP Approved Zone 2, or Public Water Supply Wells near this needs area. Therefore, there are no known water supply concerns for this area.

Priority Conclusions: These criteria represent environmental constraints to development and on-site system siting in the needs area. While continued use of on-site systems is possible for this area, a net reduction in nitrogen loading would require installation of enhanced on-site systems. With no change to the current regulations, these upgrades are required under certain circumstances; however, it is difficult to predict the timeline of required upgrades. Therefore, this area is assigned a moderate priority for off-site treatment and disposal, due mainly to the presence of poorly draining soils, coupled with system age and percentage of past variances. The off-site priority of this area may change depending upon service to the previously analyzed Aucoot Creek Needs Area.

4.1.2.10 Upper Front Street Needs Area

The Upper Front Street needs area is located along Front Street near Brook Haven Lane, east of Route I-195. Figure 4-28 shows the extents of the Upper Front Street (Route 105) needs area.

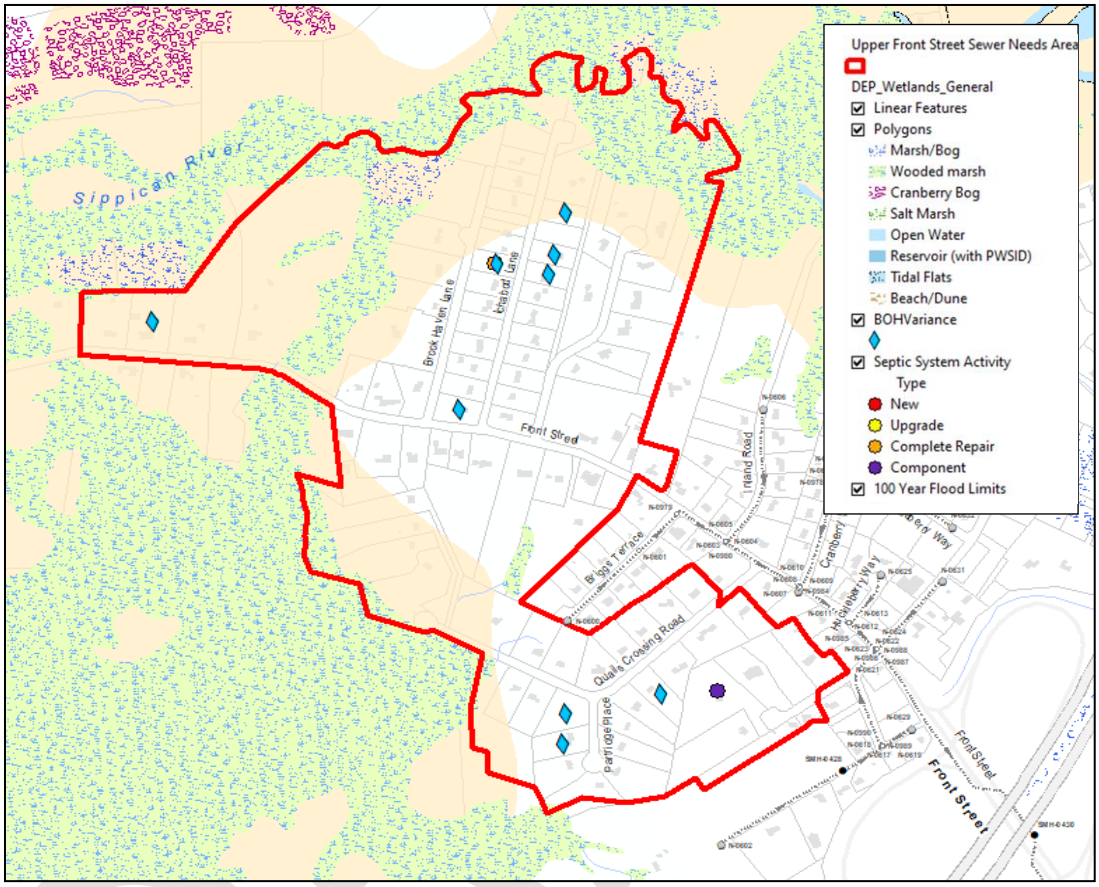

Figure 4-28: Upper Front Street Needs Area

The area is currently served by private on-site systems including approximately 102 parcels, 99 of which have been determined to be potential sewer connections. The parcels of this needs area are characterized as follows:

102 Total Parcel Lots

- 96 Parcel Lots with Existing Buildings
  - Average lot size is 1.20 acres[8]
  - Average age of home (and likely septic system) is 43 years
  - 1 Septic System Repair Documented over the last 20 years
- 6 Vacant Parcel Lots
  - 3 Developable Vacant Parcel Lots (based on current zoning)
- 10 Parcel Lots Have Been Granted Board of Health Variances for On-Site Design Systems
- Wetlands and 100 Year Flood Plain Areas are Present Along Various Lots

[8] Lot sizes vary in the area, and some streets (e.g., Ichabod Lane) have typical lot sizes on the order of one half acre.

Board of Health Records: At 43 years, the average age of the existing septic systems is beyond their 40-year life expectancy. As shown in Figure 4-28, ten parcels (11% of all parcels in the needs area) have been granted variances for on-site systems since 2000. This number of variances indicates that there has not been significant nor consistent known challenges to fulfilling title 5 requirements for existing on-site systems in the needs area. However, the average age of systems indicates that these systems may require increased frequency of repair or replacement in the future.

Wetlands & Floodplain Boundaries: Based on information shown in Figure 4-28, 47% of the needs area lies within the 100-year floodplain. There are a number of wetlands present in the needs area. The location of the floodplain may make it difficult to site on-site systems on several of the parcels in this needs area, particularly those on the northern and western ends of the needs area.

Land Use, Zoning, & Lot Sizing: The projected future wastewater flow for the Upper Front Street needs area is based on the zoning characteristics of the area as shown in Figure 4-29 and Table 4-21. The needs area is zoned residential. An average parcel size of approximately 1.2 acres is, in general, sufficiently large enough for siting on-site systems. Similarly, the zoning and land use are not expected to pose challenges to the use of on-site systems in the future. Based on zoning, the projected average day flow is estimated to be 16,300 GPD for all parcels either already developed or able to be developed in the future.

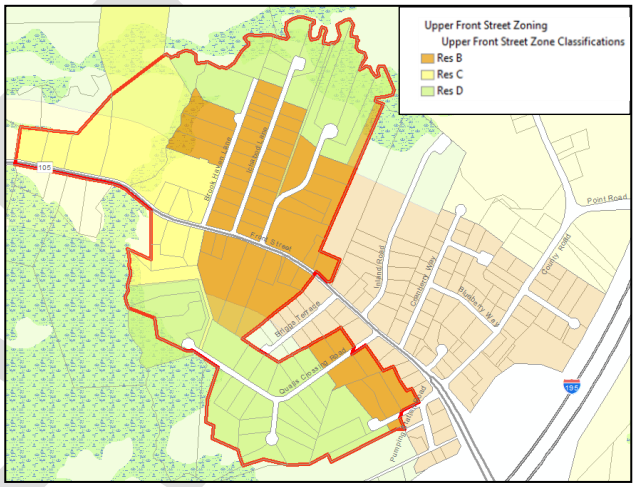

Figure 4-29: Upper Front Street Needs Area Zoning Map

Table 4-21: Projected Sanitary Flow – Upper Front Street Needs Area

Zoning District	% of Land Area	Number of Lot Connections	Flow Rate Per Lot - Max Day (GPD)	Projected Max Day Flow (GPD)	Projected Average Day Flow (GPD)[2]
Residence B	50	99	330[1]	32,700	16,300
Residence C	13				
Residence D	37				
			Total Future Flow Projection	32,700	16,300

[1] Assumes 3 Bedrooms Per Lot, Multiplied by 110 GPD Per Bedroom
[2] Assumes Average Day Flow = 1/2 * Max Day Flow

Nitrogen Loading: The Upper Front Street needs area is bounded to the north by the Sippican River which has several impairments, but none for nitrogen. If no action is taken in the Upper Front Street needs area, it is expected that this needs area would produce 3.5 lb/day – 5.6 lb/day of total nitrogen, some portion of which would discharge to the Sippican River, based on a total future flow projection of 16,300 GPD.

Soil Characteristics: Soils in this area consist mostly mix of well draining, moderately draining, and poorly or very poorly draining soils, as shown in Figure 4-30 and Table 4-22. However, the majority of built or developable parcels have at least some well or moderately draining soils. Therefore, the presence of poorly and very poorly draining soils, as well as some excessively draining soils, may present a limited challenge to siting fully compliant septic systems in this needs area in the future.

Table 4-22: Soil Drainage Distribution for Upper Front Street Needs Area

Soil Description	% of Land Area
Excessively Draining	4
Well Draining	22
Moderately Draining	40
Poorly/ Very Poorly Draining	24

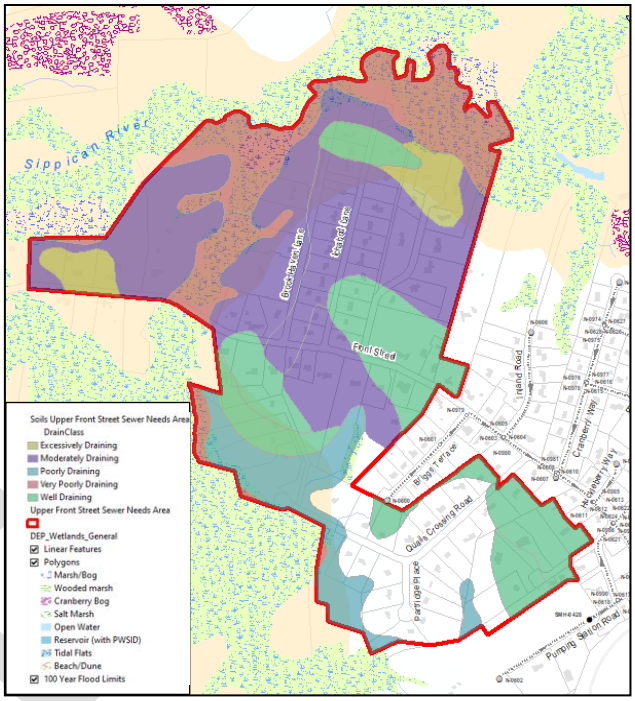

Figure 4-30: Upper Front Street Needs Area Soils Profile

Water Supply Protection: A DEP approved Zone 2 and a public water supply well are both present just south of the boundary for the Upper Front Street needs area as shown in Figure 4-31, Upper Front Street Water Resource Map. The proximity of public water supply well may pose challenges in siting on-site systems in the needs area in the future. Additionally, existing septic systems in this area may be contributing excess nitrogen to the protected resource area. While much of Marion's water supply currently comes from Rochester, it remains important to protect all available water supplies for future use, if needed.

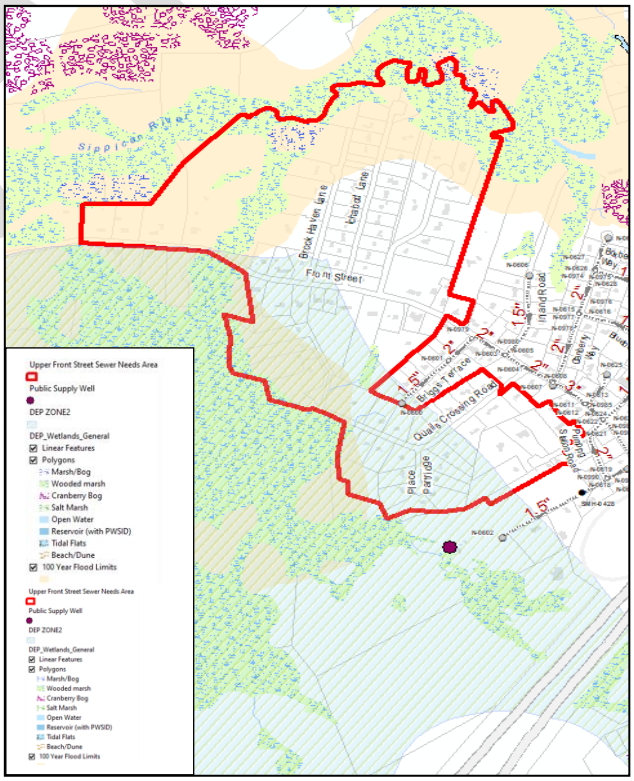

Figure 4-31: Upper Front Street Needs Area Water Resource Map

Priority Conclusions: These criteria represent environmental constraints to development and on-site system siting in the needs area. While continued use of on-site systems is possible for this area, a net reduction in nitrogen loading would require installation of enhanced on-site systems. With no change to the current regulations, these upgrades are required under certain circumstances; however, it is difficult to predict the timeline of required upgrades. Due to a portion of this area being in a water supply protection district, nutrient removal is an important factor. The average age indicates that these systems may require increased frequency of repair or replacement in the

future, and the location of excessively draining soils challenge the ability to site new or upgraded systems. Therefore, this area is assigned a high priority for off-site treatment and disposal, due mainly to its proximity to both drinking water supply zones and the Sippican River and the potential for nitrogen contribution to those resources.

4.1.2.11 County Road Needs Area

The County Road needs area is located along County Road near Point Road (lying primarily west of Route I-195). Figure 4-32 shows the extents of the County needs area.

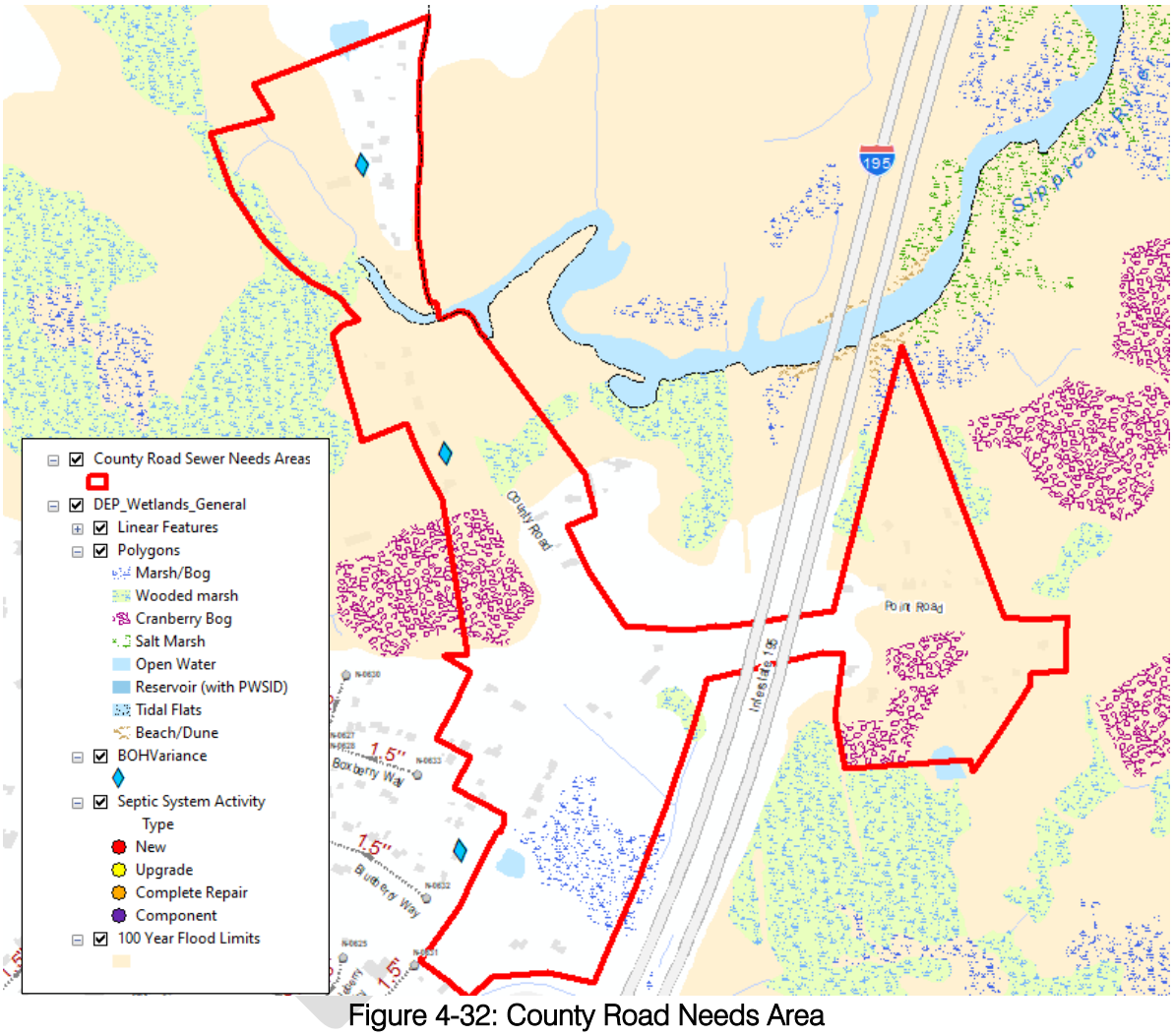

Figure 4-32: County Road Needs Area

The area is currently served by private on-site systems including approximately 67 parcels, 53 of which have been determined to be potential sewer connections. The parcels of this needs area are characterized as follows:

67 Total Parcel Lots

- 39 Parcel Lots with Existing Buildings
  - Average lot size is 0.89 acres
  - Average age of home (and likely septic system) is 43 years

- 28 Vacant Parcel Lots
  - 14 Developable Vacant Parcel Lots (based on current zoning)
- 2 Parcel Lots Have Been Granted Board of Health Variances for On-Site Design Systems
- Wetlands and 100 Year Flood Plain Areas are Present Along Various Lots

Board of Health Records: At 43 years, the average age of the existing septic systems is beyond their 40-year life expectancy. As shown in Figure 4-32, two parcels (3% of all parcels in the needs area) have been granted variances for on-site systems since 2000. This number of variances indicates that there have not been significant nor consistent known challenges to fulfilling title 5 requirements for existing on-site systems in the needs area. However, the average age of systems indicates that these systems may require increased frequency of repair or replacement in the future.

Wetlands & Floodplain Boundaries: Based on information shown in Figure 4-32, more than 55% of the needs area lies within the 100-year floodplain. There are minimal wetlands present in the needs area. The location of the floodplain may make it difficult to site on-site systems on several of the parcels in this needs area, particularly those on the northern end of the needs area and east of I-195.

Land Use, Zoning, & Lot Sizing: The projected future wastewater flow for the County Road needs area is based on the zoning characteristics of the area as shown in Figure 4-33 and Table 4-23. The needs area is zoned residential. An average parcel size of approximately 0.89 acres is, in general, sufficiently large enough for siting on-site systems. Similarly, the zoning and land use are not expected to pose challenges to the use of on-site systems in the future. Based on zoning, the projected average day flow is estimated to be 8,700 GPD for all parcels either already developed or able to be developed in the future.

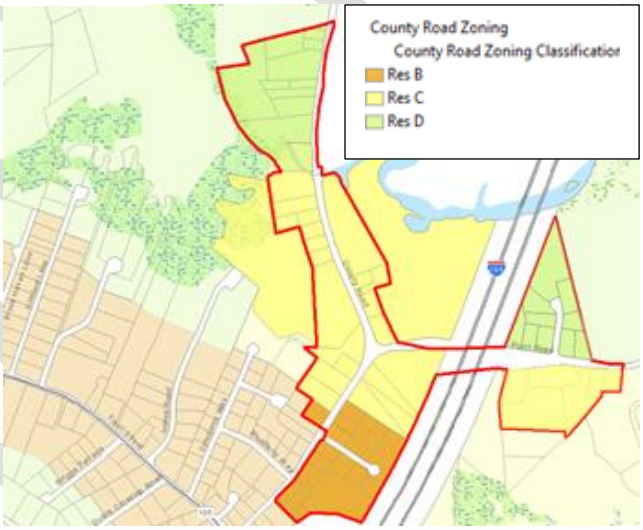

Figure 4-33: County Road Needs Area Zoning Map

Table 4-23: Projected Sanitary Flow – County Road Needs Area

Zoning District	% of Land Area	Number of Lot Connections	Flow Rate Per Lot - Max Day (GPD)	Projected Max Day Flow (GPD)	Projected Average Day Flow (GPD)[2]
Residence B	15	53	330[1]	17,500	8,700
Residence C	50				
Residence D	35				
			Total Future Flow Projection	17,500	8,700

[1] Assumes 3 Bedrooms Per Lot, Multiplied by 110 GPD Per Bedroom
[2] Assumes Average Day Flow = 1/2 * Max Day Flow

Nitrogen Loading: A portion of the County Road needs area borders the Sippican River which has several impairments, but none for nitrogen. If no action is taken in the County Road needs area, it is

expected that this needs area would produce 1.8 lb/day – 2.6 lb/day of total nitrogen, some portion of which would discharge to the Sippican River, based on a total future flow projection of 8,700 GPD. There are also two cranberry bogs in this needs area that can be susceptible to issues related to excess nitrogen.

Soil Characteristics: Soils in this area consist mostly of a mix of well draining, moderately draining, and poorly or very poorly draining soils, as shown in Figure 4-34 and Table 4-24. However, the majority of built or developable parcels have at least some well or moderately draining soils. Therefore, the presence of poorly and very poorly draining soils, as well as some excessively draining soils, may present a limited challenge to siting fully compliant septic systems in this needs area in the future.

Table 4-24: Soil Drainage Distribution for County Road Needs Area

Soil Description	% of Land Area
Excessively Draining	12
Moderately Draining	52
Poorly/ Very Poorly Draining	33
Well Draining	3

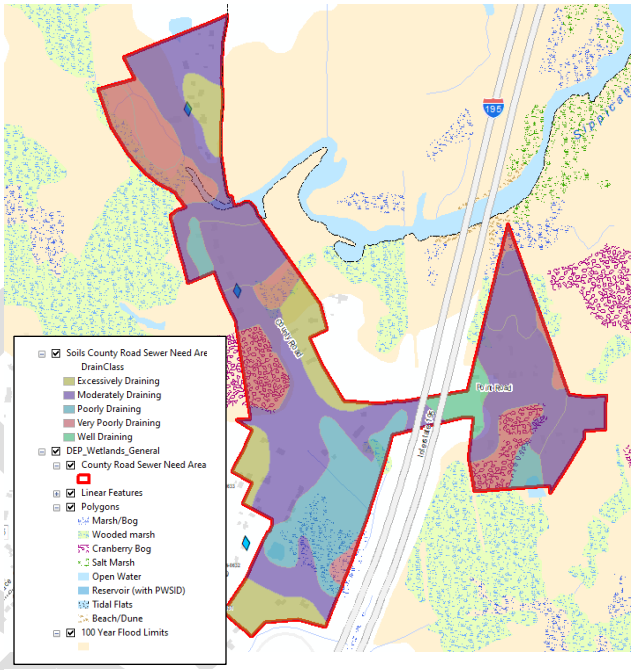

Figure 4-34: County Road Needs Area Soils Profile

Water Supply Protection: There are no known DEP water resource areas Zone A, IWPAs, Wetland Protection Zone 1, DEP Approved Zone 2, or Public Water Supply Wells near this needs area. Therefore, there are no known water supply source concerns for this area. However, the existing public water distribution system does not extend through this entire needs area, so some properties have both a drinking water well and septic system on their developed lots.

Priority Conclusions: These criteria represent environmental constraints to development and on-site system siting in the needs area. Continued use of on-site systems poses a challenge to this area particularly with parcels that have both a drinking water well and septic system on-site or to proposed developable lots that would require both on-site. A net reduction in nitrogen loading would require installation of enhanced on-site systems. With no change to the current regulations, these upgrades are required under certain circumstances; however, it is difficult to predict the timeline of required upgrades. The location of poorly draining soils and the presence of some floodplain challenge the ability to site new or upgraded systems. Therefore, this area is assigned a medium priority for off-site treatment and disposal, due mainly to its varied on-site challenges for system siting and for continued mitigation of nutrients to the Sippican River and adjacent cranberry bogs.

4.1.2.12 Unsewered Needs Area Summary

A matrix method of evaluation was used to develop the prioritization of needs areas to aid in deciding which areas would provide the most environmental benefit to an off-site (sewer connection) solution. Some areas have a level of environmental need based on general site characteristics (lot size, estimated age of system, etc.), but are able to maintain on-site systems without negative environmental impact. The characteristics of each needs area identified in the prior sections were collated into Table 4-25 below, and a preliminary priority ranking of "high," "medium," or "low" need was initially assigned to each area. Priority was given to needs areas with the greatest severity of challenges to the continued and future use of on-site treatment systems. Highest priority was assigned based on the challenges described in Section 4.1.1 in the approximate order provided below. This initial application considered combined or cumulative characteristics and will be reviewed with project stakeholders to gain input and confirmation:

- Greatest Estimated Nitrogen Loading to an Area Proximate to Nitrogen Impaired Water
- Least Ground Area for On-Site Systems
- Proximity to Resource Areas and Floodplains
- Insufficient Draining Soil Characteristics
- Prior BOH Variances and Age of Systems

Table 4-25: Unsewered Needs Area Summary Initial Prioritization

Needs Area	Total # Parcels with Possible On-Site Systems	# Parcels with Existing Buildings	# Developable Vacant Parcel Lots	Review Criteria									Priority
				Estimated Total Nitrogen Loading (lb/day)		Proximate Nitrogen Impairment	Average Age of System (years)	# BOH Variances since 2000 (% of Systems)	Land Use & Zoning	Avg Lot Size (acres)	Soil Characteristics		Flood Plain Protections 100-year floodplain	Other	
				BEST CASE	WORST CASE						Excessive Draining	Poor/Very Poor Draining			
River Road / Wareham Road	82	77	5	3.0	4.8	Weweantic River	42	2 (3%)	Majority Residence A and C	0.55	17%	13%	33%	-	High
Lower Sippican Neck	38	36	2	1.3	2.1	None	68	7 (21%)	All Residence D	1.5	0%	39%	83%		High
Planting Island	79	75	4	2.8	4.4	None	60	12 (18%)	All Residence D	0.3	81%	4%	71%		High
Aucoot Creek	44	41	3	1.5	2.4	Aucoot Creek	36	4 (9%)	Majority Residence C	1.4	0%	31%	59%		High
Upper Front Street	99	96	3	3.5	5.6	None	43	10 (11%)	Residence B, C, D	1.2	4%	24%	47%	Well Protection Zone	High
Lower Mill Street	111	104	7	3.9	6.2	None	54	13 (13%)	All Residential Districts	1.3	0%	30%	14%		Medium
Wings Cove / Piney Point	196	180	16	6.9	10.8	None	59	16 (10%)	Majority Residence C	1.8	0%	13%	42%		Medium
County Road	53	39	14	1.8	2.6	None	43	2 (3%)	Residence B and C	0.9	17%	33%	55%	Some private wells	Medium
Delano Road / Weweantic River	33	31	2	1.2	1.8	Weweantic River	48	5 (17%)	Majority Residence D	1.2	0%	5%	41%		Low
Converse Point	26	23	3	0.9	1.4	None	55	2 (9%)	All Residence D	2.6	0%	6%	72%		Low
Allens Point/ Harbor East	34	29	5	1.2	1.8	Inner Sippican Harbor	86	1 (3%)	All Residence D	2.4	14%	11%	57%		Low

For each unsewered needs area, an estimate of future flow of wastewater was produced based on the number of parcel lot connections which could be connected to sewer in the future. The full justification for these flow values can be found in Sections 4.1.2.1 through 4.1.2.11. A summary of projected Needs Area Sanitary Flow is shown below in Table 4-26.

Table 4-26: Projected Sanitary Flow – Needs Areas

Needs Area	Number of Lot Connections	Projected Average Daily Flow (GPD)	Projected Max Day Flow (GPD)
River Road / Wareham Road	82	14,000	28,000
Delano Road / Weweantic River	33	5,500	10,900
Wings Cove / Piney Point	196	32,300	64,700
Lower Sippican Neck	38	6,300	12,600
Planting Island	79	13,000	26,100
Allens Point	34	5,600	11,200
Converse Point	26	4,300	8,600
Aucoot Creek	44	7,300	14,500
Lower Mill Street	111	18,300	36,700
Upper Front Street	99	16,300	32,700
County Road	53	8,700	17,500
Total Sanitary Flow Projection for All Needs Areas		**131,700 GPD**	**263,400 GPD**

4.2 Collection System Needs

Needs within the collection system can be segregated by their component systems, but several key needs areas are present for all: resiliency planning, capacity increases, and condition improvements. These needs, as well as some specific programmatic needs are summarized for each component of the collection system in the sections that follow.

Information presented on the existing conditions within the sewer system was presented in Section 2 of this CWMP. This information is not repeated in this section (with limited exceptions), and reference to that discussion may be made for more detail on the nature of specific needs.

4.2.1 *Town-Owned Sewers*

There are more than 22 miles of Town-owned sewer in Marion. Though some of the sewers in outlying parts of Marion were constructed relatively recently, much of the system dates back to the 1970s, and most of the sewer in Marion Village is even older (some are believed to have been constructed more than a century ago). The age and low-lying nature of the system make it subject to high infiltration and inflow. Marion must address its extraneous flow in order to meet the needs of a projected increased demand in capacity of municipally treated wastewater (discussed in Section 3.2.1), and a noted concern for system resiliency (discussed in Section 2.3.3).

Marion has been committed to investigating and correcting deficiencies in its sewer system for many years, as evidenced by its work on I&I control. Over more than a decade, the Town has invested in a

multi-phased Sewer System Evaluation Survey (SSES) effort, along with completing repairs to its sewer system. More recently, the Town has implemented a Capacity Management Operation and Maintenance (CMOM) program, furthering its commitment to protecting the integrity of the sewer system. As part of its commitment to CMOM, Marion has most recently completed two years of a new ongoing 10-year Annual Program to investigate and repair the collection system on a regular basis - thereby identifying and repairing I&I sources to reduce flow within the system. The long-term program will allow the Town to protect (and possibly recover) existing capacity through I&I reduction, while the collection system management component of the program will endeavor to decrease the number of blockages, back-ups and sewer system overflows (SSOs), and customer claims. The details of the Annual Program are presented in Section 2.3.2, including the sewer investigation and improvement schedule through 2029. There is a need for Marion to continue its CMOM program and to investigate and repair the system through its Annual Program (and beyond) in order to best maintain the collection system.

A number of areas within the existing sewer system are known to have structural or other conditions that will have a need for long term correction. These known system needs include the following:

- Pipes in Easements/Rights-of-Way – Marion has a large number of private roads/rights-of-way, and there are both public and private sewer lines located in many of these areas. In general, there are areas where sewer lines are located outside of the Town controlled rights-of-way where easements would normally be taken to preserve the Town's ability to operate and maintain the system. It appears that limited easements have been taken for sewer lines that run across parcels or are located in private ways. This issue also results in some sewers being encroached upon by private construction (a current example has been identified on Hiller Street, where the sewer main lies within 10 feet of a dwelling). Overall, this issue needs general attention by the Town.

- Asbestos Sewer Pipes – Significant parts of the Marion sewer system were constructed with pipe materials that contain asbestos (i.e., asbestos cement, AC, or Transite pipes). Despite being 50 years old, many of these pipelines may still be in good condition (and may continue in service for many years). However, due to the safety concerns with handling asbestos materials and special waste disposal requirements, these pipes create a long-term challenge for the Town.

- Manhole Covers – The Town staff has also noted a concern with a significant number of manhole covers which have been paved over in various areas, as well as the presence of older castings which are in need of replacement. Ensuring the integrity and accessibility of manhole covers should be part of the Town's CMOM program going forward.

- Mill Street Extension – The sewer lines in the Mill Street Extension area have been a known source of maintenance problems for many years. In 2018, funds were appropriated by Town Meeting to replace the sewer lines in this area, and additional funds were appropriated at the 2021 Town Meeting for this and several other small system repairs. The design of the sewer replacement work was substantially complete as of April 2022, and the project was substantially constructed by the end of 2021.

- Point Road – The existing sewer mains running along Point Road between Wareham Road (Route 6) and the Point Road Pump Station (near the intersection of Bullivant Farm Road) have been noted by the operations staff as having areas where settlement of the subgrade has

caused 'sags' in the gravity sewer lines. This area was recently inspected with CCTV (in 2020 and 2021), and a number of deficiencies were identified. This line should be monitored and considered for possible long-term replacement.

- Marion Village – The original sewer system serving the village area is very old, and a good number of the original sewer lines are still in use. This system includes clay pipes and smaller diameter mains, and issues related to structural concerns and root intrusion is a continuing concern in these areas. The ongoing sewer rehabilitation program has corrected, replaced or lined a number of these pipes, and the area should continue to see attention to assure conditions in these lines are corrected before significant failures occur.

4.2.2 *Private Sewers*

Needs similar to those of the Town-owned sewers exist for the private systems. Those which are aging and exist in low-lying areas contribute to infiltration, and to a lesser extent inflow, and the capacity demands on the system as a whole. The Town has limited provisions in place to ensure the adequate operation and maintenance of these private systems, and the capacity of the private system owners to provide such proper maintenance is uncertain.

Due to the prevalence of private sewer lines in Marion, many residents are not aware that their own sewer service connects through a private line. This creates significant confusion and delays when a sewer maintenance issue arises in these areas. In many cases, even if the Town were to respond to an issue with private lines, there is a general lack of reliable record drawings for these systems.

There is also need for the Town to consider the burden of accepting private systems into the Town-owned system and any associated maintenance. The Town should consider options to permanently accept the private lines into the public sewer system, and sunset the policy of allowing private systems to exist within the Town (as part of the WPCF service area).

4.2.3 *Grinder Pumps*

The Town of Marion policy of maintaining the sewage grinder pumps for many homes connected to the sewer system has been identified as a concern for the Town. The responsibility to maintain these pumps, which are part of the private sewer connections, and located on private property, comes with significant liability, both short-term and potentially long-term. A part of this concern is the question of what happens when the pumps reach the end of their service life – which is a significant concern considering the age of most of the pump units for which the Town has responsibility. The fact that the Town is responsible to maintain some, but not all of the pumps connected to the system, also creates confusion among the residents using these systems. This disparity in turn complicates the work of the Town staff to care for the overall system.

The short-term needs are related to the maintenance of the grinder pump units. The initial service agreements for individual grinder pumps, which were put in place shortly after installation of the Town-maintained grinder pumps, will need to be reviewed (and renewed, if appropriate). The Town needs to evaluate the plan and policy for grinder pump servicing going forward, and continue to make provisions to maintain the units within the Town's current responsibility.

The long-term need related to the grinder pumps is a question of policy. Based on the history of events and on the past Town Meeting vote regarding the policy, it may take significant public outreach efforts

and a new superseding vote to change the general policy with regard to the Town's obligations to maintain the grinder pump units. Furthermore, the debt service on the SRF loan that included the purchase and installation of the grinder pumps will not be retired until 2034, so any consideration to adjust the Town's level of maintenance responsibility for the grinder pumps will need to consider legal obligations related to the loan debt.

At this time, the Town needs to review the policy and engage local discussions. A revised policy for use going forward should be developed. The grinder pump policy needs to address:

- Ownership of the grinder pump units,
- Responsibility for maintenance of the units,
- Access provisions for maintenance and limits of responsibility,
- Obligations for equipment/system replacement,
- Sunsetting of responsibility and transition of maintenance, as appropriate,
- Administrative, regulatory and budget provisions related to the grinder pumps.

This long-term policy plan also needs to be considered when evaluating options for new sewer extensions that may include new low pressure sewer systems with individual grinder pumps.

4.2.4 *Pump Station Needs*

Marion's eight municipal sewer pump stations are representative of the aging critical infrastructure that is common throughout the state and region. Half of the Town's pump stations are at least 50 years old, and only a few have received upgrades in the past 20 years. As facilities that are required to operate continuously, 365 days per year, the needs of these stations may be considered essential to the Town's sewer system.

The needs for the existing sewer pumps stations can be separated into several categories:

- Capacity Needs
- Modernization Needs, including Age Related Conditions, and Technology Limitations
- Sustainability, including Resiliency, Efficiency, and Safety Needs

The most notable pump station needs are summarized below for each station. The focus of this report is to identify substantial needs for the pump stations, and as such these discussions do not address operations, maintenance and immediate repair needs. Those needs, while they may be significant, are expected to be addressed in the short-term, as part of the ongoing operation and maintenance (O&M) for the stations. There are also programmatic needs related to pump stations in general, which are presented here separate from the individual pump station needs.

4.2.4.1 General and Programmatic Needs for Sewer Pump Stations

The following general and programmatic needs are observed, and are common to all stations or to Marion's overall system:

- Conditions of the sewer pump stations tend to change over time, and due to the critical function of these stations, the stations should be reviewed periodically to identify short- and long-term issues affecting the station's functionality. These detailed reviews should include engineering and operations considerations.

- All of Marion's pump stations discharge through pressurized force mains. In all cases, a single force main must remain in constant service. This makes it difficult to complete detailed evaluation of the force main conditions. The unknown condition of the force mains serving the Town's eight pump stations is a significant liability, and the costs related to a repair of these lines can be extremely high. An assessment of these pipelines is needed to determine what repairs or protective actions should be implemented. The assessment should be prioritized for the larger, more critical pump stations (Front Street and Creek Road).

- Pump stations require operator attention, and the details of the design and construction are critical to allowing for proper function, as well as operation and maintenance. When new pump stations are to be built by developers or private parties, or existing privately built stations are to be accepted by the Town, it is critical that the Town require these stations to meet the same criteria as would be used for a pump station constructed by the Town. The Town needs a clear policy to prevent the construction and acceptance of sub-standard pump stations.

- Though not necessarily limited to Marion's pump stations, the Town should develop and implement a monthly inspection program that includes all emergency equipment. A formal training program for the use of this equipment and other OSHA topics should be developed.

4.2.4.2 Front Street Pump Station

Needs related to the Front Street (Main) Pump Station include the following:

- All of the future sewer extension needs areas (as well as anticipated future development) would be tributary to the Front Street PS. Based on the design of the PS incorporating high flow pumps, the capacity of this PS generally appears adequate to handle future sanitary flows. However, a detailed capacity review should be conducted prior to connecting significant new flows to the system.

- Equipment, including piping and valving, exhibit signs of deterioration, and the VFDs are in need of replacement. The existing wetwell influent sluice gate is not functional and needs replacement. The existing pumps present reliability and service concerns. Based on the age of the PS and the time since the last significant upgrade, a short-term renovation of the PS is needed (as a minimum).

- General safety provisions should be addressed. The Front Street PS includes confined spaces in the wetwell area, which is common for sewer pump stations. The Town should develop safety protocols, and train for specific procedures related to confined space entry and lockout/ tagout. The need for other safety upgrades should be considered, including those for guards on equipment, fall prevention, and signage.

- The Front Street PS is located within the existing 100-year flood zone and in a Category 1 hurricane inundation zone. The 2019 detailed vulnerability assessment of Marion's pump stations ranked the Front Street PS as the second highest station in Vulnerability and the second highest station in Risk. Despite the elevated entrance design of the pump station (above the current 100-year flood elevation), future flood projections show that the station will need to be elevated further to protect from future flood impacts.

- The 2021 CZM grant funded bypass design project also included identifying resiliency improvements needed to extend the resiliency of the station to meet future flood conditions. These improvements are expected to allow continued service of the Front Street PS over the coming 20 years or more. In the future (beyond that planning period), this station will need major reconstruction or replacement in order to meet the long-term resiliency design standards and address all station concerns.

- The Front Street PS discharges through a force main that varies in diameter (12-inch and 14-inch), and which was installed in part under several different contracts. A detailed assessment of the force main condition is needed. Based on the criticality of the PS, the addition of a second (redundant) parallel force main should be considered.

4.2.4.3 Silvershell Pump Station

Needs related to the Silvershell Pump Station include the following:

- One of the future sewer extension needs areas (as well as possible future development) would potentially be tributary to the Silvershell PS. As such, additional future capacity needs exist for this pump station.

- Equipment, including piping and valving, exhibit signs of deterioration. Based on the age of the PS and the time since the last significant upgrade, a short-term renovation of the PS is needed (as a minimum), including replacement of the pumps and ancillary work.

- General safety provisions should be addressed. The old wetwell area within the building was never properly abandoned, so correcting this is a key safety need. The Silvershell PS includes confined spaces in the wetwell area, which is common for sewer pump stations. The Town should develop safety protocols, and train for specific procedures related to confined space entry and lockout/ tagout. The need for other safety upgrades should be considered, including those for increased signage and entry ladder extensions.

- The Silvershell PS is located within the existing 100-year flood zone and in a Category 2 hurricane inundation zone. The 2019 detailed vulnerability assessment of Marion's pump stations ranked the Silvershell PS as the fourth highest station in Vulnerability and the fourth highest station in Risk. Existing flood zones and future flood projections show that the station will need to be elevated to protect from future flood impacts.

- In order to meet the long-term resiliency design standards and address all station concerns, this station will need to be reconstructed/replaced in the future.

- The Silvershell PS discharges through an old asbestos cement (AC) force main, the condition of which is uncertain. A detailed assessment of the force main condition is needed, and a replacement project will likely need to be a consideration for this force main.

4.2.4.4 Creek Road Pump Station

Needs related to the Creek Road Pump Station include the following:

- A number of future sewer extension needs areas (as well as anticipated future development)

would be tributary to the Creek Road PS. As such, additional future capacity needs exist for this pump station.

- The Creek Road PS needs complete replacement. Key factors supporting this need include the station's elevation well below current (and projected future) flood elevations, the operational and safety issues related to the PS configuration, age and design of equipment, the lack of a dedicated ability to bypass the station during an emergency, and capacity concerns.

- The Creek Road PS is located in the velocity zone within the existing 100-year flood zone, and in a Category 1 hurricane inundation zone. The 2019 detailed vulnerability assessment of Marion's pump stations ranked the Creek Road PS as the highest station in Vulnerability and the third highest station in Risk. Existing velocity/flood zones and future flood projections show that the station will need to be elevated to protect from future flood impacts.

- The Creek Road PS discharges through an 8-inch diameter cast iron force main that was installed c. 1972. A detailed assessment of the force main condition is needed. Based on the criticality of the PS, the addition of a second (redundant) parallel force main should be considered.

In late 2020, the Town of Marion was awarded funding from the CZM Grant Program for the design of a replacement of the Creek Road Pump Station. Design of a resilient system to replace the existing deficient PS was completed in June 2021. The Town is seeking additional grant funds to allow the PS improvement project to proceed to construction.

4.2.4.5 Oakdale Pump Station

Needs related to the Oakdale Pump Station include the following:

- None of the future sewer extension needs areas are tributary to the Oakdale PS. As such, additional future capacity needs are not anticipated for this pump station.

- The Oakdale PS is problematic in its design and location. Though the station is functional, the equipment and systems exhibit signs of deterioration, and the configuration of this PS makes maintenance a challenge. Based on the age of the PS and the time since the last significant upgrade, a short-term renovation of the PS would normally be recommended. However, due to the major deficiencies with this station, only short-term repairs should be considered until this station can be reconstructed.

- General safety provisions should be addressed. The Oakdale PS includes confined spaces in the wetwell area, which is common for sewer pump stations. The Town should develop safety protocols, and train for specific procedures related to confined space entry and lockout/ tagout.

- The Oakdale PS is located in the velocity zone within the existing 100-year flood zone and in a Category 1 hurricane inundation zone. The 2019 detailed vulnerability assessment of Marion's pump stations ranked the Oakdale PS as the third highest station in Vulnerability and the highest station in Risk. Existing flood zones and future flood projections show that the station will need to be elevated to protect from future flood impacts.

- In order to meet the long-term resiliency design standards and address all station concerns, this station will need to be reconstructed/replaced in the future.

- The Oakdale PS discharges through a force main which is just under 30 years old. The force main condition Is uncertain, but the line is known to run cross-country through private property. No records of the exact force main location are available, and easements are not known to exist for the force main alignment. An assessment of the force main location and condition is needed, and proper easements should be obtained to ensure access for maintenance activities.

4.2.4.6 Littleneck Pump Station

Needs related to the Littleneck Pump Station include the following:

- None of the future sewer extension needs areas are tributary to the Littleneck PS. As such, additional future capacity needs are not anticipated for this pump station.

- The PS location and configuration present significant challenges for operation and maintenance (O&M). Key among these challenges is access to the wetwell for the pumps system and control system. While this is the newest of the Town's pump stations, a renovation of the PS will be needed (as a minimum) in the next 10 years to address the major issues.

- General safety provisions should be addressed. The Littleneck PS includes confined spaces in the wetwell area, which is common for sewer pump stations. The Town should develop safety protocols, and train for specific procedures related to confined space entry, lockout/ tagout, and traffic safety.

- The Littleneck PS is located above the existing flood zone, but below the future projected flood elevations, and in a Category 2 hurricane inundation zone. The 2019 detailed vulnerability assessment of Marion's pump stations ranked the Littleneck PS as the Town's lowest station in Vulnerability and the lowest station in Risk. Future flood projections show that the station may need to be elevated to protect from future flood impacts.

- In order to meet the long-term resiliency design standards and address all station concerns, this station may need to be reconstructed/replaced in the future (this is a long-term issue at this station, as the location and current conditions are less critical than at other pump stations).

4.2.4.7 Parkway Lane Pump Station

Needs related to the Parkway Pump Station include the following:

- None of the future sewer extension needs areas are tributary to the Parkway Lane PS. As such, additional future capacity needs are not anticipated for this pump station.
  .
- The Parkway Lane PS is problematic due to its design and condition. Though the station is functional, the equipment and systems (controls in particular) are deteriorated, and the configuration of this PS (particularly the inaccessibility of the isolation valves) makes maintenance a challenge. Based on the age of the PS and the time since the last significant upgrade, a short-term renovation of the PS is needed (as a minimum).

- General safety provisions should be addressed. The Parkway Lane PS includes confined spaces in the wetwell area, which is common for sewer pump stations. The Town should develop safety protocols, and train for specific procedures related to confined space entry and lockout/ tagout.

- The Parkway Lane PS is located within the existing 100-year flood zone and in a Category 2 hurricane inundation zone. The 2019 detailed vulnerability assessment of Marion's pump stations ranked the Parkway PS as the sixth highest station in Vulnerability and the fifth highest station in Risk. Existing flood zones and future flood projections show that the station will need to be elevated to protect from future flood impacts.

- In order to meet the long-term resiliency design standards and address all station concerns, this station may need to be reconstructed/replaced in the future (this is a long-term issue at this station, as the location and current conditions are less critical than at other pump stations).

4.2.4.8 Point Road Pump Station

Needs related to the Point Road Pump Station include the following:

- One of the future sewer extension needs areas (as well as possible future development) may be tributary to the Point Road PS. As such, additional future capacity needs may exist for this pump station.

- This station was upgraded approximately 15 years ago, but some equipment are exhibiting signs of deterioration. Based on the age of the PS and the time since the last upgrade, a renovation of the PS will be needed (as a minimum) in the next 10 years to address the major issues.

- General safety provisions should be addressed. The lower level of the old ejector equipment vault was not properly abandoned and poses a safety concern. The Point Road PS includes confined spaces in the wetwell area, which is common for sewer pump stations. The Town should develop safety protocols, and train for specific procedures related to confined space entry and lockout/ tagout.

- The Point Road PS is located within the existing 100-year flood zone and in a Category 2 hurricane inundation zone. The 2019 detailed vulnerability assessment of Marion's pump stations ranked the Point Road PS as the second lowest station in Vulnerability and the sixth highest station in Risk. Existing flood zones and future flood projections show that the station will need to be elevated to protect from future flood impacts.

- In order to meet the long-term resiliency design standards and address all station concerns, this station will need to be reconstructed/replaced in the future (this is a long-term issue at this station, as the location and current conditions are less critical than at other pump stations).

4.2.4.9 Stoney Run Pump Station

Needs related to the Stoney Run Pump Station include the following:

- None of the future sewer extension needs areas are tributary to the Stoney Run PS. As such, additional future capacity needs are not anticipated for this pump station.

- Although this is the newest pump station constructed by the Town, a number of deficiencies (notably related to controls) exist that should be addressed. The Stoney Run PS is now 25 years old and will eventually need renovation to address these issues.

- General safety provisions should be addressed. The Stoney Run PS includes confined spaces in the wetwell area, which is common for sewer pump stations. The Town should develop safety protocols, and train for specific procedures related to confined space entry and lockout/ tagout.

- The Stoney Run PS is located just at the existing flood zone (with critical equipment elevated above the existing flood elevation), but below the future projected flood elevations, and in a Category 2 hurricane inundation zone. The 2019 detailed vulnerability assessment of Marion's pump stations ranked the Stoney Run PS as the fifth highest station in Vulnerability and the second lowest station in Risk. Future flood projections show that the station may need to be elevated to protect from future flood impacts.

- In order to meet the long-term resiliency design standards and address all station concerns, this station may need to be reconstructed/replaced in the future (this is a long-term issue at this station, as the location and current conditions are less critical than at other pump stations).

4.2.4.10 Pump Station Needs Summary

The drivers of the pump station needs are summarized in Table 4-27. The general pump station needs are further categorized in Table 4-28.

Table 4-27: Pump Station Needs Summary - Drivers

Pump Station (PS)	Capacity	Condition	Vulnerability Assessment/ Resiliency			
	Unsewered Needs Areas Tributary to PS	Equipment Deterioration	Vulnerability Rank [1]	Risk Rank [1]	Hurricane Zone (Category)	Flood Plain
Front Street	All	✓	2nd	2nd	1	100-year
Silvershell	Converse Point Lower Mill Street Aucoot Cove	✓	4th	4th	2	100-year
Creek Road	Lower Sippican Neck Planting Island Wings Cove/ Piney Point Allens Point Delano Road/ Weweantic River	✓	1st	3rd	1	100-year
Oakdale	None	✓	3rd	1st	1	100-year
Littleneck	None	✓	8th	8th	2	Below future elevations
Parkway Lane	None	✓	6th	5th	2	100-year
Point Road	Possible [2]	✓	7th	6th	2	100-year
Stoney Run	None	✓	5th	7th	2	Below future elevations

Notes: [1] This ranking is cited from the Town's 2019 report, *Assessing the Threats from Climate Change to Marion's Vulnerable Wastewater Pumping Infrastructure*.
[2] The Point Road PS could potentially see some future flow from one of two needs areas, depending on final sewer layouts.

Table 4-28: Pump Station Needs Summary

Pump Station (PS)	Future Capacity Need	Modernization Need	Resiliency Need	Safety Need		Other Needs
	Capacity Review	Renovation	Reconstruction/ Replacement	Facility Upgrades	Procedural Changes	
Front Street	✓	✓	✓ [3]	✓	✓	• Assessment of force main condition • Bypass provisions
Silvershell	✓	✓	✓	✓	✓	• Assessment of force main condition
Creek Road [1]	✓	✓	✓	✓	✓	• Assessment of force main condition • Bypass provisions
Oakdale		✓	✓		✓	• Confirm force main location
Littleneck		✓	✓ [3]		✓	
Parkway Lane		✓	✓ [3]	✓	✓	
Point Road	✓ [2]	✓	✓ [3]	✓	✓	
Stoney Run		✓	✓ [3]		✓	

Notes: [1] There is an ongoing project which is designed to upgrade the Creek Road PS.
[2] The Point Road PS could potentially see some future flow from one of two needs areas, depending on final sewer layouts.
[3] These facilities have needs which are considered longer term for modernization and/or replacement.

4.3 WPCF Needs

Information presented on the existing WPCF conditions was presented in Section 2 of this CWMP. This information is not repeated in this section (with limited exceptions), and reference to that discussion may be made for more detail on the nature of specific needs.

Marion's WPCF is comprised of components with various origination dates – the product of a series of upgrades over the past several decades. Much of the facility (primarily the headworks, SBR system, and operations building) was constructed when the WPCF was upgraded in the early 2000s, though many of these systems are approaching their 20-year service life. The currently ongoing improvements (focused on lining Lagoon No. 1) include key improvements in several areas. As treatment facilities are required to operate continuously, 365 days per year, the WPCF needs are essential to the Town.

The needs for the WPCF can be separated into several categories:

- Modernization Needs, including Age Related Conditions and Technology Limitations
- Capacity Needs
- Permit and Regulatory Compliance Needs
- Sustainability, including Resiliency, Efficiency, and Safety Needs

The most notable WPCF needs are summarized in the following discussions. The focus of CWMP planning effort is to identify substantial needs for the facility, and as such these discussions do not address normal operations, maintenance, and immediate repair needs. Those needs, while they may be significant, are expected to be addressed in the short-term, as part of the ongoing operation and maintenance (O&M) for the facility. A number of programmatic needs related to the WPCF in general have been identified and are presented here separate from the specific process needs.

4.3.1 *General and Programmatic WPCF Needs*

The following general and programmatic needs are observed for the Marion WPCF:

- Staffing for facility operations has been a historic challenge for the Marion WPCF. The operations staff have in the past been able to maintain plant operations; however, the number of staff available to support operations is limited. As such, licensed staff are frequently called upon to perform extended duty and overtime to adequately support the WPCF and collection system operations. This challenge extends to limitations in the ability for staff to take time off and presents a liability in the event of operator illness or other unplanned time off. Staffing is an industry-wide concern for wastewater treatment facilities, extending to all regions of the United States. This challenge is heightened with small systems like Marion's, where only a limited number of full-time operators are normally employed. There is a need to consider programmatic staff support options, including supplementing staff levels or partnering with other entities to assist with staffing needs. A more detailed analysis of staffing for the wastewater systems should be considered.

- Conditions of the WPCF and process systems tend to change over time. This CWMP has endeavored to identify specific needs related to WPCF systems, but the CWMP process is typically only engaged every 20 years or so. Due to the critical function of the facility and systems, the WPCF should be reviewed periodically between the more major planning efforts to identify short- and long-term issues affecting the facility's functionality. These detailed reviews should include engineering and operations considerations and be used to support the WPCF operations and capital improvements budgets.

4.3.2 *WPCF Modernization and Specific Process Area Needs*

The WPCF has varying needs for modernization and process area improvement – these are generally related to age, physical conditions, or technological deficiencies. The development of these needs is based on review of the WPCF process areas and discussion with operations staff.

4.3.2.1 Influent Pumping

The Front Street (Main) pump station is discussed separately in Section 4.2.4. The most notable needs related to this facility are focused on resiliency and reliability. Among these, the reliability of the single force main to deliver flows to the WPCF is a major area of system vulnerability.

4.3.2.2 Headworks

The headworks building is in generally good condition, though a number of systems need specific attention. The headworks area notable needs are summarized as follows.

Pre-Aeration
The pre-aeration tank has limited access for cleaning, with only one access hatch. A second access must be considered and provisions made for safe access for cleaning and maintenance. The pre-aeration tank and adjacent tank area concrete walls exhibit signs of corrosion, requiring repair and protective coating. A means of bypassing the pre-aeration tank without taking the headworks out of service should be considered.

Screening
The screen unit is functional but has been in service for over 15 years. All screen cleaning cycles are initiated automatically through the control sensors. A local control to allow operator to initiate a cleaning cycle of the screen is needed. Wash water from the plant water system tends to clog the screen spray heads, suggesting that a review of the plant water system is needed to see if quality can be improved. The manual bypass bar rack needs a custom rake to allow for efficient use when in service.

Lagoon Diversion Gate
Contrary to the original design intent, the lagoon diversion gate system does not allow the ability to split or trim flow between the headworks and lagoon. In practice this gate opens or closes only, suggesting a needs area for improvement. The further need to add redundancy to the lagoon diversion gate system should also be considered.

Grit Removal
The grit collector, pump and dewatering screw is functional, but has been in service for over 15 years. The grit cyclone was replaced in the past 5 years, but other parts will need eventual rebuild or replacement.

Odor Control
The odor control system is generally functional. One blower was out of service during the visit but should be considered a short-term repair item. The biofilter media has been periodically replaced and is again near the end of its service life. The system should be updated with new media and the air system rechecked for operation and balance considerations.

Communications
The fiber optics cable from Main Building to the Headworks building is the older type (OM1) that may need to be upgraded at some point.

4.3.2.3 Soda Ash Storage and Feed

The staff has executed a number of repairs to the soda ash system over the years. Due to the nature of the system, constant maintenance and periodic cleaning and repairs of this system are needed. Notable needs for this system include:

- Repair (or abandonment) of the permanent buried soda ash solution feed lines, which are plugged and currently non-functional, is needed. Alternately, upgrade of the 'temporary' above grade feed line may be an option (with permanent abandonment of the buried line).

- This system is subject to heavy wear due to the nature of the system. Review and upgrade of the soda ash system, including new key equipment elements, will be needed in the long term.

- The fiber optics cable from Main Building to Soda Ash system is the older type (OM1) that may need to be upgraded at one point.

4.3.2.4 Sequencing Batch Reactor (SBR) Activated Sludge Secondary Treatment

The sequencing batch reactor (SBR) treatment system was designed with two SBR basins, requiring both basins to be in operation to treat the design capacity of the WPCF. The site layout made provisions for a third future SBR basin, but the availability of the lagoons made the two-basin design appropriate. Notable needs for the SBR treatment system include:

- The SBR controls were recently improved to allow the plant to increase from 5 daily cycles per basin to 6 or 7 cycles (based on time compression). The staff needs time to work with these control improvements to troubleshoot these new operating schemes and identify any additional needed actions to support the faster cycles.

- Despite the relatively young age of the concrete tanks, several parts of the SBR tanks exhibit significant cracking and degradation in the concrete (the corner of the of the SBR tank/walkway near the soda ash silo is a notable example).

- The scum removal system designed for the plant is not used. Scum collection from the SBR tank surface is a manual process and is labor intensive. Scum improvements should be considered.

- The blower room in the operations building is subject to floor leakage from the maintenance garage area overhead (and the leakage extends to other parts of the lower building level, including the pump room). Permanent improvements are needed to protect the blowers and other equipment areas.

- The submersible mixer rails in the SBR tanks exhibit vibration issues and should be replaced.

- Plant water access is not readily available for wash down use at the SBR basins. Additional plant water hydrants are needed in this area.

- Replacement of the SBR mounted DO probes and display systems will be needed.

- The supervisory control and data acquisition (SCADA) system needs improvements (see further discussion under Instrumentation & Control Systems).

- Because these are only two SBR basins, the plant cannot run normally when one tank is taken out of service for maintenance or repair activity. The possible need for a third SBR tank was discussed with operations staff, who would consider this beneficial for plant reliability

4.3.2.5 Instrumentation & Control (I&C) Systems

By their nature, instrumentation and control (I&C) systems, and particularly advanced supervisory control and data acquisition (SCADA) systems, are subject to becoming more challenging to maintain and update over time. Based on discussions with the operating staff, the general control systems in the facility have been an increasing challenge to maintain and adapt programming. Despite some recent system improvement work, many of the controllers in the plant I&C system are older model Allen-Bradley logic controllers. It is anticipated that technical support for these controllers will become challenging

(and eventually unavailable) over the planning period. Control communication wiring in the plant should also be reviewed, as some older (OM-1) wiring is still in service in key areas of the WPCF. Also, the radio telemetry system communicating with the sewer pump stations is becoming outdated, and a replacement of that communication system is needed. A general upgrade to the instrumentation and control (I&C) systems should be considered.

4.3.2.6 Chemical Feed and Ancillary Systems

The chemical feed room in the operations building is laid out for future chemical feed needs and currently provides limited chemical feed system for hypochlorite uses in the WPCF. No notable needs were observed in this area.

The plant water system was rebuilt approximately 5 years ago. The source of the suction for plant water is the SBR equalization tank. The plant water suction location or configuration may be able to be modified to provide for less solids in the plant water.

4.3.2.7 Main Operations Building

The main operations building is in generally good condition, and provides appropriate space for systems, equipment and staff. Notable needs include the following:

- The building lacks adequate space for vehicle and trailer (e.g., generator sets) storage. Storing these in the area above the blowers should be discontinued. Additional storage space needs are discussed further in Section 4.3.2.14.

- The floor under the maintenance garage is cracked and damaged and allows leakage to the areas below. Permanent repairs to this structure are needed.

4.3.2.8 Disk Filter Building

The disk filtration system has been upgraded as part of the 2020 lagoon improvement project. As of this time there remain a number of notable needs in this process area, including the following.

- The existing Side Stream Pumping Station will need improvements, including new pumps and control system. An evaluation of the wet well concrete condition should also be completed.

- Safe access equipment should be provided to support maintenance activities in the two filter tanks. This equipment was part of the lagoon upgrade project at one point, but it was removed from the contract documents.

- The Filter Building has an existing chemical containment area that has not been utilized in many years. If in the future chemical treatment is needed, this area would need to be upgraded with new equipment.

- The fiber optics cable from Main Building to Disk Filter building is the older type (OM1) that may need to be upgraded at one point.

4.3.2.9 Ultraviolet Disinfection

The ultraviolet (UV) disinfection system has been upgraded as part of the 2020 lagoon improvement project. While there are no notable process needs in this area, the building continues to age and lack of

water-tightness is a concern. As such, architectural improvements to the building should be planned, including roof and skylight replacement and other sealing work around the building envelope (including along the floor level).

4.3.2.10 Lagoon System

A major lagoon improvements project was initiated in 2020, including removal of sludge and lining of Lagoon No. 1, as well as piping and support improvements. The Town completed removal of all sludge and installation of the lining in Lagoon No. 1 as of January 2022. Following the completion of ancillary work, Lagoon No. 1 will be placed back in service as of the end of December 2022. Following construction, the use of Lagoon No. 2 and Lagoon No. 3 is expected to be reduced.

The Town is required to complete a High Flow Management Plan as part of the regulatory orders. That plan will address how the lagoons are to be used in the future. If the intent is to keep Lagoon No. 2 and Lagoon No. 3 in service, then there are needs in the systems supporting those lagoons (e.g., aeration systems, gates/valves and berms) that will need to be addressed. As part of the planning for these lagoons, an assessment of the sludge remaining in Lagoon No. 2 may be needed.

4.3.2.11 Flow Metering

The influent and lagoon flow metering systems are generally functional, and a number of new meters were added as part of the 2020 lagoon improvements project. The hydraulic location of the effluent flow meter (before the effluent filters) presents a challenge, as it results in over-reporting of flows compared to actual effluent discharges. A new effluent flow meter system should be located downstream of the effluent filters, in order to provide accurate measurement of effluent discharge.

4.3.2.12 Surface Discharge Outfall

The existing surface water discharge outfall was partially upgraded when the plant was upgraded in the early 2000's. Access to the actual outfall, located off Abel's Way, can be a challenge seasonally. Improvements to access (specifically clearing along the pipeline route) should be considered for maintenance purposes. In addition, the older sections of the outfall pipe and manholes should be evaluated for repair needs (staff have noted that at least one of the manholes near the outfall is in poor condition).

4.3.2.13 Solids Processing

The solids handling system at the WPCF has historically included storing of all sludge in the lagoon system. As part of the 2020 lagoon improvement project, a large volume of sludge was removed from Lagoon No. 1, dewatered and hauled off site for disposal. In the future, sludge from the WPCF will be pumped to the forebay in Lagoon No. 1. A process of periodic removal of sludge from the lagoon should be considered.

4.3.2.14 Buildings and Site

Specific building deficiencies were discussed in the areas above. A noted deficiency is the need for dedicated storage of rolling equipment and vehicles, as the garage space at the WPCF is inadequate.

One other noted deficiency on the site is the lack of an adequate discharge for materials from jet truck and vactor cleaning from the sewer system. Historically, these have been discharged into Lagoon No. 1, and the lagoon improvement project provides an area for continuing this process. A dedicated vactor dump station should be considered ahead of the WPCF headworks.

In general, site electrical systems and communications systems may need upgrading, including new fiber optic communications lines between buildings to support the SCADA, new radio telemetry systems to connect the pump stations, and other instrumentation.

4.3.3 *WPCF Capacity Needs*

The flows treated at the WPCF vary significantly – in 2019 the facility treated and discharged approximately 0.591 MGD, while in 2020 this treated flow dropped to 0.455 MGD (and averaged 0.447 MGD in 2021). While lower sanitary flows from some users experienced in 2020 (and early 2021) may be attributed to the COVID-19 pandemic, this variation is primarily influenced by precipitation and groundwater impacts on system flows. Even with the continuation of the Town's aggressive infiltration and inflow control program, capacity planning for the WPCF must assume some continued long-term impacts from these extraneous flows.

The identification of unsewered areas with a potential need for future sewer connections, as well as the existence of a significant number of properties fronted by sewer and not connected, suggest that additional future capacity for sanitary flows is needed at the facility. Based on the future flows and loads projections included in Section 3.2 of this report, additional treatment and discharge capacity is needed at the WPCF. Alternatives for providing the additional capacity needs to be considered in several areas:

- First, the ability of the WPCF to treat the additional flows and loads and meet the discharge permit limits.
- Second, the needed increase in the discharge flow limit (currently 0.588 MGD) included in the Town's NPDES permit, or disposal by other means.
- Finally, the potential to address capacity needs through some regional disposal agreement (to Wareham or Mattapoisett/Fairhaven).

4.3.4 *WPCF Discharge Permit Conditions*

Based on the present and future regulatory compliance requirements discussed in the prior sections of this report, regulatory compliance needs for the WPCF include the following:

- Permitted Flows – As discussed above, an increase in the permitted discharge flow of 0.588 MGD will need to be provided for in future permitting.
- BOD and TSS – If the Town requests the ability to treat and discharge additional flows at the WPCF under its current NPDES limit, it is expected that the discharge load limits (e.g., 42 pounds per day, average monthly) for these constituents would be held constant. This means that the WPCF will need to meet lower BOD and TSS effluent concentrations at higher flows.
- Nitrogen – As with BOD and TSS, if the Town requests the ability to treat and discharge additional flows under its NPDES permit, the seasonal load limit for total nitrogen (e.g., 19.6 pounds per day, average monthly) would be held constant. This means that the WPCF will need to meet lower total nitrogen effluent concentrations at higher flows. Consideration must be given to meeting this lower concentration limit. There is also a possibility of the EPA re-introducing a

proposed lower seasonal limit (3.0 mg/l was included in the prior draft NPDES permit) for total nitrogen.

- Phosphorus – The WPCF needs to expect that it will be required to remove phosphorus in the future, as required in the current discharge permit. This established limit is based on an effluent phosphorus concentration of 0.2 mg/l. As with BOD, TSS, and nitrogen, if the Town requests the ability to treat and discharge additional flows under its NPDES permit, the seasonal load limit for total phosphorus (e.g., 0.98 pounds per day, average monthly) may be held constant. This condition would mean that the WPCF may need to meet lower total phosphorus effluent concentrations at higher flows. For phosphorus, because the limit is stayed and has yet to be formally required for the WPCF, it can be argued that holding the 0.2 mg/l concentration limit and increasing the loading would be appropriate going forward. There is also a possibility of the EPA introducing a proposed winter season limit for total phosphorus.

- Copper – In the future, the interim copper limit established in its 2007 Copper Administrative Order will sunset, and the WPCF will be required to remove copper to the lower limit included in the current discharge permit. This established limit is based on effluent copper concentrations of 7.7 ug/l (average monthly) and 11.3 ug/l (maximum daily).

- Other Pollutants – The Town has no way of knowing the requirements for additional pollutants in the system that may be regulated under future discharge permits. Reliance on sound technology for treatment is the best practice recommended to prepare for any unknown future limits. The Town should prepare for anticipated PFAS compound monitoring requirements that are likely to be included in the next permit.

4.3.5 *WPCF Resiliency and Sustainability Needs*

The Marion WPCF has specific vulnerability and sustainability characteristics, and as such these present areas which may need to be addressed. The location of the WPCF away from the coastline, at a higher relative elevation, results in the WPCF being less susceptible to coastal flooding and storm impacts (which are more critical vulnerabilities for the wastewater collection system and pumping facilities). The general vulnerabilities of the WPCF are summarized in Table 4-29.

Table 4-29: WPCF Vulnerability

Threat Type	Vulnerability Rating	Justification
Coastal Storms & Flooding	Low	Indirect impacts result from flooded collection system and pump stations.
Winter Storms	Moderate	Facility access, supply chain, and long-term power concerns.
Fire	Low	Majority of site is cleared, and critical buildings are significantly fire resistant.
Lightning	Moderate	Historic lightning strikes have caused outages, suggesting a concern for system damage.
High Winds/Tornado	Low	Facility access, supply chain and long-term power concerns.
Drought	Low	Major risk is to water supply for users and possible rate impacts.
Earthquake	Low	Risk is historically low for the area. No formal assessment has been made.
Disease/Pandemic	Moderate	Primary risk is to operating staff level, based on limited total staff available.

The primary area for concern for WPCF resiliency resulting from the assessment in Table 4-29 is the need to have a resilient staffing plan. In the event that one or more of the limited number of operations staff are incapacitated or unavailable, an alternate plan to continue to safely operate the system is needed.

From a sustainability view, the need to meet low nutrient (nitrogen and phosphorus) limits in the effluent requires a higher level of treatment that consumes more energy and chemicals. As such, these plants are generally less sustainable in practice than plants producing lower quality effluent. This lesser sustainability is due to the several key factors:

- Higher energy use (primarily aeration and filters) to meet lower BOD, TSS and nutrient limits.
- Greater chemical usage, including chemical manufacturing, trucking and cost impacts.
- Greater sludge generation due to the increased biological and chemical processes, resulting in higher trucking and disposal cost impacts.
- Greater impact on staff time to meet and monitor the systems.
- Higher lab costs for increased monitoring required by the permits.

The Marion plant will likely continue to have stringent effluent requirements, limiting the options for energy savings on the site. One sustainability area that should be explored is the disposal of solids from the process, as the long-term storage of solids in the lagoons has been found to be problematic.

4.3.6 *WPCF Needs Summary*

A summary of the overall WPCF needs is included in Table 4-30. General needs are organized by key process areas and systems, though a number of needs categories require significant programmatic attention.

Table 4-30: WPCF Needs Summary

Process Area or Category	Modernization/ Condition Needs	Capacity Needs	Permit/ Regulatory Needs	Sustainability/ Resiliency Needs
General & Programmatic	✓	✓	✓	✓
Influent Pumping Systems	✓			✓
Headworks Systems	✓			
SBR / Biological Treatment	✓	✓	✓	
Chemical Feed & Ancillary Systems	✓	✓	✓	
Main Operations Building	✓		✓	✓
Disk Filter Building	✓			
Effluent UV Disinfection	✓			
Lagoon System	✓		✓	
Flow Metering	✓	✓	✓	
Surface Discharge Outfall	✓		✓	✓
Solids Processing	✓	✓	✓	✓
Buildings & Site	✓	✓		✓
Electrical & Control Systems	✓	✓	✓	
Overall Level of Needs	**High**	**High - Moderate**	**High**	**Moderate**

4.4 Needs Relating to Wastewater Budget and Sewer User Rates

When considering overall needs for wastewater management in Marion, one unusual aspect should be included in discussions – the affordability of user costs. This need is summarized as follows:

- Affordability of User Costs – Marion's sewer user rates are notably high, particularly in comparison to other communities. EPA has established affordability criteria that categorizes the burden placed on users as significant if it exceeds two percent (2%) of median household income. In Marion, billing information suggests that the current annual cost of sewer user charges for a typical sewer user is in the range of $1,370 to $1,630 per year (see Section 2.6 of this report). These costs represent approximately 1.67% to 1.99% of the reported $81,928 median household income for Marion (see Section 2.1.1 of this report). The need to maintain affordable user costs should therefore be considered in the review of alternatives to address wastewater needs.

4.5 Summary of Needs

As presented in this section of the CWMP report, Marion's wastewater management needs are significant and varied. Wastewater management needs for individual properties (particularly those properties not currently connected to municipal sewer) have been identified and prioritized, and should be further analyzed for potential sewer connection. Additional needs exist associated with existing municipal pipeline, pump stations and WPCF infrastructure. These needs include current and future system capacity, regulatory, efficiency, modernization, and resiliency considerations. Programmatic needs are also notable, related to: financial and operating constraints, management and servicing of grinder pumps, and policies related to private collection systems. Alternatives to address all of these identified needs should be evaluated, and recommended actions should be developed.

5.0 ALTERNATIVES IDENTIFICATION, SCREENING AND ANALYSIS

This section of the CWMP discusses alternatives that have been identified, screened and considered as feasible to address the conditions and needs presented in the previous sections. This section is organized to include the following, which are discussed further below.

- Wastewater Management Alternatives for Unsewered Areas
- Sewer Technology Alternatives for Extension of Sewers
- Alternatives for Addressing Existing Collection System and Pump Station Conditions
- Alternatives to Address WPCF Needs

5.1 Wastewater Management Alternatives

Building on prior planning and environmental studies, the needs analysis identified which areas in Marion face the greatest challenges in relying on on-site systems for wastewater disposal. Multiple alternatives for wastewater management have been identified to address these challenges. Each alternative may be classified as an on-site solution (one which is physically located at the property on which the waste is generated), or as an off-site solution (one which is located remotely from the waste generating property).

5.1.1 *Identification of On-Site Wastewater Solutions*

On-site systems include individual septic systems that treat and dispose of wastewater on the same parcel on which the wastewater is generated. These systems often consist of a septic tank to separate solids and a leaching field to treat the liquid fraction of the wastewater and re-distribute the discharge back to the ground. Some on-site systems provide additional treatment components, such as those for additional nitrogen removal which are required of all new septic systems in Marion.

Conventional septic systems are governed in Massachusetts by Title 5, the State Environmental Code. These septic systems are not designed to achieve a high level of treatment of biochemical oxygen demand (BOD), total nitrogen removal, or phosphorus removal. Properly designed, installed, and maintained systems still discharge some level of pollutants into the groundwater. Unsaturated soils in a soil absorption system are effective at removing bacteria, viruses, and some nutrients (with the exception of some forms of nitrogen and high levels of phosphorus). Systems with saturated soils, an inadequate separation between the soil absorption system and the groundwater, rapidly percolating soils, an inadequately designed soil absorption system, or other limitations will contribute even higher levels of pollutants to the groundwater. Therefore, it is sometimes desirable, particularly in sensitive areas, to achieve a higher level of treatment than a conventional Title 5 system can provide.

Current Title 5 regulations allow for the use of innovative/alternative (I/A) technologies under the provisions of Sections 15.280 – 15.289 of the Code. Alternative systems provide substitutes or alternatives for one or more of the components of a conventional system while providing equal or greater environmental and health protection. The revised Title 5 regulations specifically identify the requirements for approval of I/A technologies, and classify the level of approval as remedial, piloting, provisional, and general. These alternatives are being used throughout the state for upgrades of systems on-site systems that cannot accommodate a conventional system. A list of approved I/A system technologies is maintained on the Massachusetts DEP web site.

The Town of Marion recently adopted enhanced regulations governing the design and use of septic systems. These regulations specifically provide for system design using technologies which will reduce

the total amount of nitrogen being discharged into the environment. These systems, where required by the new regulations, will provide a better level of treatment than conventional on-site technologies.

In some communities, an enhanced level of management is added to ensure that individual on-site systems are properly operated and maintained, and repaired or replaced when necessary. These additional measures are often implemented when other steps (such as local regulations) fail to address challenges with on-site systems. These programmatic approaches to enhancing the effectiveness of on-site treatment systems may take a number of forms, ranging from passive programs of public education, to system maintenance/pumping reminders, to enhanced regulations (going even further than Marion's recent regulations), and more organized systems such as full-scale inspection and maintenance programs. These more intense approaches require significant staff and resources to implement, and have been tried by a number of Cape Cod communities to address wastewater management challenges. Communities must carefully consider engaging in more intensive management programs, as maintaining the lines between municipal responsibilities and individual property owner responsibilities can be a challenge.

5.1.2 *Identification of Off-Site Wastewater Alternatives*

Off-site systems collect wastewater from a community or neighborhood and treat and dispose of the wastewater on a parcel separate from the wastewater generation point(s). Off-site system solutions may include:

- Localized sewer systems (cluster) with a shared Title 5 or enhanced treatment system
- Localized sewer systems with a neighborhood wastewater treatment system
- Centralized sewer systems with a large-scale wastewater treatment plant (such as the Marion WPCF)

These off-site options are each described in the sections that follow.

5.1.2.1 Shared Title 5 Systems

Groups of homes or businesses that discharge a total of 10,000 gallons per day (GPD) or less of wastewater (on a maximum daily flow basis) can use Title 5 requirements to design their wastewater treatment and disposal site. This off-site alternative is the most similar to conventional on-site 'septic' systems as used for individual properties. Typically, shared Title 5 systems are large on-site systems located on a vacant parcel or an available portion of a larger developed parcel in a neighborhood where individual lots have challenges in siting on-site systems (e.g., smaller lot sizes). In most instances, shared systems are made up of a larger septic tank and a larger leaching field. On occasion, however, in environmentally sensitive areas, these systems require additional components/equipment (e.g., I/A technology, as discussed in Section 5.1.1) to provide an increased level of treatment. Shared systems generally serve a collection area of less than thirty, average-size (3-bedroom) homes, and can be as small as just a few homes sharing a system on the property of one or several homeowners.

Shared Title 5 systems require special approval from DEP, as well as legal agreements and documentation regarding ownership, maintenance and repair responsibilities. Shared systems must be pumped at least once per year. A conventional shared system for a particular area would include a localized collection system, a large septic tank, a dosing (pump) chamber, and a large soil absorption system. For design flows over 5,000 GPD, leaching trenches are the only type of soil absorption system allowed by DEP. Assuming the use of leaching trenches, the footprint for a 10,000 GPD soil absorption system could be approximately 1 acre or more, including sufficient reserve area. Availability of suitable

land is therefore often a limiting factor in the application of shared systems. A second major factor is the administrative and legal constraints of having several property owners share the system's costs.

Shared or cluster systems are generally considered appropriate alternatives where the area in question lies remote from the centralized sewer system, or where other reasons exist for not connecting to a centralized system.

5.1.2.2 Small Decentralized Cluster or Neighborhood Treatment Systems (NTS)

This type of off-site system collects wastewater from a localized area that is larger than that allowed for a Title 5 system (i.e., will generate a flow greater than 10,000 GPD), and requires construction of a small, neighborhood treatment and groundwater disposal system. This type of off-site system is relatively new compared to centralized sewer systems, but offers the benefit of groundwater recharge with higher quality effluent than individual on-site systems. Groundwater recharge is a term used for putting treated water back into the same general area from which it was taken (or a remote area with suitable soils), in order to replenish the groundwater.

A neighborhood treatment system generally includes below ground tankage and small-scale wastewater treatment components/equipment, which are often enclosed or supported by a small above ground structure. Groundwater disposal systems are similar to leaching fields used in on-site systems, but they generally have a larger footprint designed to process greater flows of high-quality effluent. Groundwater discharges require a Massachusetts DEP permit to discharge the effluent to the ground. Siting a system can be challenging based on the need for a suitable discharge site.

This wastewater management alternative could generally be considered for areas in Marion where groundwater recharge would be beneficial to replenish base flow to area surface waters (ponds, brooks, streams or rivers) or to recharge the groundwater supply in drinking water aquifers.

The difficultly in analyzing and recommending this wastewater management alternative is public acceptance. Due mainly to the negative connotation associated with wastewater and the idea of having a 'treatment plant' in a neighborhood, there is often resistance on the part of local residents to allow a municipality to locate an NTS. A good deal of public education on this wastewater management alternative may need to be conducted to support this concept in local areas. Even after a potential site has passed the public acceptance test, the site must be technically analyzed to confirm that soils are appropriate to adequately filter the NTS effluent, that groundwater is deep enough to not cause a surcharge or excess mounding effect, and that sensitive receptors (such as drinking water supplies, surface waters, wetlands, etc.) are not negatively impacted.

Like smaller shared systems, neighborhood treatment systems are generally considered appropriate alternatives where the area in question lies remote from the centralized sewer system, or where other reasons exist (such as a lack of available system capacity) for not connecting to a centralized system.

5.1.2.3 Centralized Sewer and Large-Scale Treatment Plant at Marion WPCF

Marion currently utilizes a system of sewer mains to collect wastewater flow from residences, businesses, and institutions and deliver it to the municipal WPCF at Benson Brook Road. The sewer system currently receives flow predominantly from the Village area and other densely populated sections of Marion. Wastewater is treated at the WPCF to produce a high-quality effluent with very low nitrogen content, prior to discharge.

Since the Town has a centralized sewer system, extension of new sewer pipelines to serve needs areas and return flow to the WPCF is an appropriate alternative. Analysis of this alternative, however, requires confirmation that both the existing sewer system and the existing WPCF have available capacity. In many cases, some downstream improvements to the existing sewer system would be needed to extend sewers to the needs areas. These issues are further discussed in the remainder of this section.

One of the major challenges for this alternative is the fact that there is limited remaining capacity available in the Marion WPCF. As such, the impacts of connecting areas to the centralized sewer system include a need for increased treatment capacity at the WPCF and for an increase in permitted effluent flow. The discussion of alternatives for WPCF is therefore dependent on the selected alternatives for the unsewered needs areas.

Similarly, these same alternatives apply to the discussion of alternatives for treatment at sites other than the Marion WPCF, as is the case for the noted regional treatment option that has been discussed with Wareham. Therefore, these final treatment location discussions are held to later in this Alternatives section of the CWMP.

5.1.3 *Screening and Evaluation of Wastewater Management Alternatives*

Following up on information presented in the Needs Analysis, the applicability of on-site and off-site solutions for wastewater management to various areas of Marion helps focus the best alternative for each area. For the purposes of this evaluation, we have organized the alternatives for the unsewered areas into four tiers:

- No Action – No significant action or change is required by the Town, and on-site systems may continue to be used. Responsibility for maintaining each septic system remains solely with the individual property owner. This includes compliance with all current regulations.

- Enhanced On-Site Treatment – On-site systems may continue in use, but enhancements to the systems are needed. In Marion, the recent regulations relating to nitrogen treatment in new septic systems are examples of this type of approach, though further regulations or management programs are likely to be needed.

- Localized Treatment/Shared System – A localized treatment approach is appropriate based on remoteness of the areas from the centralized sewer system, and subject to the availability of an appropriate site for effluent disposal.

- Extension of Centralized Sewers – Extension of sewers is possible and needed as the area is poorly suited to long-term reliance on on-site wastewater treatment and disposal.

In general, the unsewered areas in Marion were originally developed using on-site (Title 5) systems, and as such can be supported by such on-site solutions. The best solution for areas which can continue to be supported by on-site systems is typically to maintain those systems, and to repair and reconstruct those systems, where and when necessary.

Cost Considerations

The discussion of alternatives includes a discussion of the costs related to each feasible alternative. The cost information presented is based on general experiences in the implementation of similar systems.

Planning level costs are, by nature, not precise because the details of constructing any type of system are major factors in determining costs, and such details are yet to be established during the planning process. These planning level costs are intended to cover general construction and construction related costs. In all cases, the cost basis is presented for comparison of alternatives, and more precise costs (if desired) would only be available for systems for which design details are developed more fully. For comparison purposes, we have carried costs forward in tables to show two significant digits; though this does not suggest a degree of 'precision' for these costs. Further discussion of costs for recommended improvements will be provided in Section 6 of this CWMP.

For planning level costs of sewer extensions, this report uses typical "all in" unit costs for various systems (e.g., cost per linear foot for pipelines, and lump sum costs for pump systems and appurtenant work). This method allows general scaling of anticipated costs to the size of a needed system. In the instance of treatment systems, costs are based on experience with similar systems. For localized treatment systems, costs include an "all in" unit cost per gallon per day of maximum daily treatment capacity, plus a fixed 'base cost' to represent the economy of scale in building larger facilities. Specific costs are included in the tables in each section.

The cost to maintain a functional Title 5 system for a single-family home is generally low, consisting primarily of the cost to monitor and periodically pump the septic tank. The costs for these systems are more challenging when the need arises to repair the system, to significantly upgrade, or replace the entire system. The capital costs for septic system replacement vary widely as these costs are a function of many factors. For single family homes, some repairs are reported to be possible for as low as several thousand dollars, and replacement costs as high as $100,000 or more have been reported. However, conventional septic system replacement costs are likely to generally vary from $15,000 to $40,000 for a typical single-family home. The new Marion regulations requiring septic systems to treat to lower levels of nitrogen are more costly than conventional systems. While less cost history is available for these systems, the cost for such a system is expected to range from $30,000 to over $50,000 for a typical single-family home. Due to the variation in costs for system replacement, the financial comparison of on-site and off-site solutions for properties is subjective and site-specific.

Nitrogen Considerations

In Marion (as with other Buzzards Bay and Cape Cod communities), the discharge of nitrogen from wastewater is a significant concern affecting local waters. The load of nitrogen from poorly functioning or even normally functioning septic systems is significant. The Marion WPCF consistently treats to very low levels of nitrogen, as is required by permit. As such, nitrogen mitigation, as well as overall water quality protection, must be considered in deciding whether an area should be serviced by an off-site solution (such as a sewer extension). As presented in prior sections of this report, nitrogen load assumptions for the alternatives analysis are as summarized in Table 5-1.

Table 5-1: Nitrogen Discharge Levels from Various Treatment Options

System/ Treatment Approach	Anticipated Nitrogen Discharge Concentration[1]	Alternatives Using this Approach	Notes
Conventional (Title 5) Septic Systems	26 – 42 mg/l	No Action	Non-Title 5 compliant systems (e.g., cesspools) may discharge ≥65 mg/l N
Enhanced (I/A) Septic Systems	19 mg/l	Enhanced On-Site Treatment	This is a theoretical target number for N discharge from new I/A systems.
Treatment at Localized Treatment System	10 mg/l	Localized Treatment	This is a permit requirement for groundwater discharge which is expected for any small treatment system.
Treatment at Marion WPCF	4 mg/l	Sewer Extension	This is a permit requirement, and Marion's WPCF consistently produces this level of N or lower.

[1] Anticipated nitrogen discharge concentration for conventional (Title 5) septic systems is anticipated to range between 26 and 42 mg/l per the October 2020 Article, *Distributed Nitrogen Removing I/A Septic Systems: A 2020 Primer for Cape Cod* by Bruce Walton. To calculate the anticipated nitrogen loading for each given needs area, a concentration of 35 mg/l was used, along with the current approximate flow rate from each needs area. This concentration assumes approximately 95% of existing conventional systems are operating within the bounds of Title 5, and that approximately 5% are more poorly functioning.

Specific discussions of the alternatives screened and evaluated for each sewer needs are included in the following sections.

5.1.3.1 River Road/Wareham Road Area

The River Road/Wareham Road area includes parcels adjacent to a proposed development (Heron Cove Estates), and as such, coordination with the proposed development team has included provisions to allow future connection of this area to the centralized sewer system. The suitability of alternatives for this area is summarized in Table 5-2.

Table 5-2: Alternative Screen for River Road/ Wareham Road Needs Area

Alternative	Key Factors for Screening	Selected for Further Consideration
No Action	Area is adjacent to impaired waters. This alternative does not significantly reduce nitrogen impact. Some smaller lot sizes and limited separation to waterways.	
Enhanced (I/A) Septic Systems	Enhanced on-site treatment may allow for some reduction of nitrogen impacts to waterways.	✓
Localized (Cluster) Treatment	Area is close to existing sewer system, making sewer extension more feasible than localized treatment.	
Sewer Extension	Existing system is close to the needs area and will provide maximum reduction of pollutant load.	✓

Based on this preliminary screening, two feasible alternatives are considered for this needs area – enhanced on-site treatment and extension of sewers.

Enhanced On-Site Treatment

This alternative would include developing and implementing a program to provide more advanced treatment using on-site systems in the needs area. Based on a preliminary review of the area, the average lot sizes and soil conditions appear to allow the implementation of this alternative in the area.

For the purposes of assessing nitrogen impacts, this report assumes that the area is currently served primarily by fully compliant Title 5 septic systems. Therefore, the current nitrogen load is estimated using an average discharge concentration of 35 mg/l for the existing systems. Under this alternative, a program to improve systems in the needs area over time would be implemented. At the conclusion of such a program, the assumption is that the systems in this area would meet current target levels of optimal nitrogen removal for on-site systems, producing average discharge concentration of 19 mg/l.

Summary of Nitrogen Reduction

Conventional Septic Systems: 12,700 GPD @ 35 mg/l → 3.7 lb/day of N
Proposed Enhanced Systems: 12,700 GPD @ 19 mg/l → 2.0 lb/day of N

Net Reduction of Nitrogen = 1.7 lb/day of N (>45% reduction)

Cost of improvements to septic systems in the area will vary significantly, as the characteristics of individual lots are different. However, for the purposes of cost considerations, this report assumes that each on-site system in the area will eventually need to be upgraded to meet new standards, and that the average cost of these upgrades will be $40,000 or more per system. One advantage of this approach is that the improvements to individual systems can be implemented over a rolling schedule, where systems are upgraded on a schedule controlled by individual property owners.

Extension of Public Sewers

The existing sewer system lies in relatively close proximity to the River Road/Wareham Road needs area. Based on a preliminary review, an extension of public sewers to the needs area was laid out for planning and cost development purposes. If this area is selected for sewering, detailed design should be implemented to confirm the approach to extending sewers to this area.

The River Road/Wareham Road area may be served by a system composed primarily of gravity sewer lines with a new sewer pump station to be located near the intersection of River Road and Wareham Road. As depicted on Figure 5-1 (attached), this area would include installing new sewers on River Road, parts of Wareham Road, Hill Street, Oak Street, Green Street and Marvel Street. The new pump station would discharge to the new gravity sewer on Wareham Road, and the area would ultimately connect to the existing sewer main on Wareham Road just east of the intersection of Point Road. Based on a recent review of the downstream impacts of connecting this area and the proposed Heron Cove Estates development on Wareham Road, downstream capacity in the sewer lines generally exists for the flows from this area. However, the Creek Road pump station is in need of upgrade and replacement (which has been designed as of July 2021).

For the purposes of assessing nitrogen impacts, this alternative would include transmitting wastewater to the Marion WPCF for treatment and discharge. The WPCF currently treats to a level of 4 mg/l or less of total nitrogen before the discharge of effluent. This is far better than the current nitrogen load from the area from septic systems, which is estimated using an average discharge concentration of 35 mg/l for the existing systems. In the case of the alternative where the area is connected to the Marion WPCF, the final nitrogen load is also moved from the existing area (contributing to the Weweantic River) to the ultimate receiving water of the WPCF, Aucoot Cove.

Summary of Nitrogen Reduction

Conventional Septic Systems: 12,700 GPD @ 35 mg/l → 3.7 lb/day of N
Marion WPCF Treatment: 12,700 GPD @ 4 mg/l → 0.4 lb/day of N

Net Reduction of Nitrogen = 3.3 pounds per day of N (>88% reduction)

The planning level construction costs related to extension of sewers to this area are summarized in Table 5-3.

Table 5-3: River Road/ Wareham Road Needs Area Sewer Extension Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	4,900 ft	$1,500,000	The Town has requested that the Heron Cove Estates developer construct a portion of the needed gravity sewer on Wareham Road.
Low Pressure Sewer	-	-	None anticipated.
Sewer Force Main	1,500 ft	$190,000	Partially parallel with new gravity sewer.
Sewer Pump Station	1 PS	$600,000	Site location to be determined in further study.
On-lot Grinder Pumps	-	-	None anticipated.
Downstream Sewer Improvements	-	-	None anticipated.
Summary	-	$2,300,000	-

Based on the anticipation that the sewer extension to this area would serve approximately 82 unsewered parcels, the average cost per parcel to extend sewers to this area is approximately $28,000 per parcel.

Comparison of Alternatives

The comparison of feasible alternatives for the River Road/Wareham Road area is summarized in Table 5-4.

Table 5-4: Summary of Alternatives for River Road/ Wareham Road Needs Area

Alternative	Nitrogen Impacts	Approximate Cost per Parcel	Other Considerations
Enhanced On-Site Treatment	Nitrogen load reduced to 2.0 lb/day (>45% reduction)	$40,000	Requires additional septic system regulations and enforcement to achieve nitrogen reduction.
Sewer Extension	Nitrogen load reduced to 0.4 lb/day (>88% reduction)	$28,000	Some costs may be reduced by contributions from local developers.

5.1.3.2 Delano Road/Weweantic River Area

The Delano Road/Weweantic River area consists mainly of properties along the Weweantic River. The suitability of alternatives for this area is summarized in Table 5-5.

Table 5-5: Alternative Screen for Delano Road/ Weweantic River Needs Area

Alternative	Key Factors for Screening	Selected for Further Consideration
No Action	Area is adjacent to impaired waters, though lot sizes are relatively large.	✓
Enhanced (I/A) Septic Systems	Enhanced on-site treatment may allow for some reduction of nitrogen impacts to waterways.	✓
Localized (Cluster) Treatment	Area is close to existing sewer system, making sewer extension more feasible than localized treatment.	
Sewer Extension	Existing system is close to the needs area and will provide maximum reduction of pollutant load.	✓

Based on this preliminary screening, three feasible alternatives are considered for this needs area – no action, enhanced on-site treatment, and extension of sewers.

No Action
This alternative requires no significant action or change by the Town, and on-site systems may continue to be used. Responsibility for maintaining each septic system remains solely with the individual property owner. This includes compliance with all current regulations, including the *Septic System Denitrification Regulation* which requires that denitrification systems be installed for new systems and replacement of nonconforming failed systems at the time of transfer. This regulation will likely lead to a reduction of nitrogen from septic systems, though occurring over a long (indeterminate) time period.

Enhanced On-Site Treatment
This alternative would include developing and implementing a program to provide more advanced treatment using on-site systems in the needs area. Based on a preliminary review of the area, the average lot sizes and soil conditions appear to allow the implementation of this alternative in the area.

For the purposes of assessing nitrogen impacts, this report assumes that the area is currently served primarily by fully compliant Title 5 septic systems. Therefore, the current nitrogen load is estimated using an average discharge concentration of 35 mg/l for the existing systems. Under this alternative, a program to improve systems in the needs area over time would be implemented. At the conclusion of such a program, the assumption is that the systems in this area would meet current target levels of optimal nitrogen removal for on-site systems, producing average discharge concentration of 19 mg/l.

Summary of Nitrogen Reduction
Conventional Septic Systems: 5,200 GPD @ 35 mg/l → 1.5 lb/ day of N
Proposed Enhanced Systems: 5,200 GPD @ 19 mg/l → 0.8 lb/ day of N

Net Reduction of Nitrogen = 0.7 pounds per day of N (>45% reduction)

Cost of improvements to septic systems in the area will vary significantly, as the characteristics of individual lots are different. However, for the purposes of cost considerations, this report assumes that each on-site system in the area will eventually need to be upgraded to meet new standards, and that the average cost of these upgrades will be $40,000 or more per system. One advantage of this approach is that the improvements to individual systems can be implemented over a rolling schedule, where parcel upgrade systems on a schedule are more desirable to individual property owners.

Extension of Public Sewers

The existing sewer system lies in relatively close proximity to the Delano Road/ Weweantic River needs area. Based on a preliminary review, an extension of public sewers to the needs area was laid out for planning and cost development purposes. If this area is selected for sewering, detailed design should be implemented to confirm the approach to extending sewers to this area.

The Delano Road/ Weweantic River area may be served by a system composed primarily of low pressure sewer lines with grinder pumps installed at each connection. As depicted on Figure 5-2 (attached), this area would include installing new sewers on parts of Cross Neck Road and Delano Road. The new sewer would connect at Delano Road and Dexter Road after replacing the small diameter existing sewer line on Delano Road from Bass Point Road to that point. Based on a preliminary review, downstream capacity in the sewer lines is believed to exist for the limited additional flows from this area.

For the purposes of assessing nitrogen impacts, this alternative would include transmitting wastewater to the Marion WPCF for treatment and discharge. The WPCF currently treats to a level of 4 mg/l or less of total nitrogen before the discharge of effluent. This is far better than the current nitrogen load from the area from septic systems, which is estimated using an average discharge concentration of 35 mg/l for the existing systems. In the case of the alternative where the area is connected to the Marion WPCF, the final nitrogen load is also moved from the existing area (contributing to the Weweantic River) to the ultimate receiving water of the WPCF, Aucoot Cove.

Summary of Nitrogen Reduction

Conventional Septic Systems: 5,200 GPD @ 35 mg/l → 1.5 lb/day of N
Marion WPCF Treatment 5,200 GPD @ 4 mg/l → 0.2 lb/day of N

Net Reduction of Nitrogen = 1.3 pounds per day of N (>88% reduction)

The planning level construction costs related to extension of sewers to this area are summarized in Table 5-6.

Table 5-6: Delano Road/ Weweantic River Area Sewer Extension Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	-	-	None anticipated.
Low Pressure Sewer	3,200 ft	$640,000	-
Sewer Force Main	-	-	None anticipated.
Sewer Pump Station	-	-	None anticipated.
On-lot Grinder Pumps	33	$330,000	-
Downstream Sewer Improvements	1,100 ft	$220,000	Replace existing 2" LP sewer along Delano Road with 3" LP from Bass Point Road to Dexter Road.
Summary	-	$1,200,000	-

Based on the anticipation that the sewer extension to this area would serve approximately 33 unsewered parcels, the average cost per parcel to extend sewers to this area is approximately $36,000 per parcel.

Comparison of Alternatives

The comparison of feasible alternatives for the Delano Road/ Weweantic River area is summarized in Table 5-7.

Table 5-7: Summary of Alternatives for Delano Road/ Weweantic River Needs Area

Alternative	Nitrogen Impacts	Approximate Cost per Parcel	Other Considerations
No-Action	Nitrogen load remains at 1.5lb/day	Unknown	Individual system actions would likely occur over time, as needed by individual conditions.
Enhanced On-Site Treatment	Nitrogen load reduced to 0.8 lb/day (>45% reduction)	$40,000	Requires additional septic system regulations and enforcement to achieve nitrogen reduction.
Sewer Extension	Nitrogen load reduced to 0.2 lb/day (>88% reduction)	$36,000	

5.1.3.3 Wings Cove/ Piney Point

The Wings Cove/ Piney Point area consists mainly of parcels in the middle portion of the Sippican Neck peninsula. The suitability of alternatives for this area is summarized in Table 5-8.

Table 5-8: Alternative Screen for Wings Cove/ Piney Point Needs Area

Alternative	Key Factors for Screening	Selected for Further Consideration
No Action	Area is adjacent to several waterways, though none have known impairments. Lot sizes are sufficient for septic system siting, though flood plains and other environmental constraints may limit siting of these systems.	✓
Enhanced (I/A) Septic Systems	Enhanced on-site treatment may allow for some reduction of nitrogen impacts to waterways.	✓
Localized (Cluster) Treatment	Due to the large number of parcels in this area, siting challenges and cost of a larger local treatment system make this less feasible.	
Sewer Extension	Existing system is close to the needs area, and will provide maximum reduction of pollutant load.	✓

Based on this preliminary screening, three feasible alternatives are considered for this needs area – no action, enhanced on-site treatment, and extension of sewers.

No Action

This alternative requires no significant action or change by the Town, and on-site systems may continue to be used. Responsibility for maintaining each septic system remains solely with the individual property owner. This includes compliance with all current regulations, including the *Septic System Denitrification Regulation* which requires that denitrification systems be installed for new systems and replacement of nonconforming failed systems at the time of transfer. This regulation will likely lead to a reduction of nitrogen from septic systems, though occurring over a long (indeterminate) time period.

Enhanced On-Site Treatment

This alternative would include developing and implementing a program to provide more advanced

treatment using on-site systems in the needs area. Based on a preliminary review of the area, the average lot sizes and soil conditions appear to allow for the implementation of this alternative in the area.

For the purposes of assessing nitrogen impacts, this report assumes that the area is currently served primarily by fully compliant Title 5 septic systems. Therefore, the current nitrogen load is estimated using an average discharge concentration of 35 mg/l for the existing systems. Under this alternative, a program to improve systems in the needs area over time would be implemented. At the conclusion of such a program, the assumption is that the systems in this area would meet current target levels of optimal nitrogen removal for on-site systems, producing average discharge concentration of 19 mg/l.

Summary of Nitrogen Reduction

Conventional Septic Systems: 29,700 GPD @ 35 mg/l → 8.7 lb/day of N
Proposed Enhanced Systems: 29,700 GPD @ 19 mg/l → 4.7 lb/day of N

Net Reduction of Nitrogen = 4.0lb/ day of N (>45% reduction)

Cost of improvements to septic systems in the area will vary significantly, as the characteristics of individual lots are different. However, for the purposes of cost considerations, this report assumes that each on-site system in the area will eventually need to be upgraded to meet new standards, and that the average cost of these upgrades will be $40,000 or more per system. One advantage of this approach is that the improvements to individual systems can be implemented over a rolling schedule, where parcel upgrade systems on a schedule are more desirable to individual property owners.

Extension of Public Sewers

The Wings Cove/ Piney Point needs area is relatively distant from the existing sewer system (the nearest sewers to this area are the private Point Road sewer lines, which are insufficiently sized to present any options in sewering this area). Based on a preliminary review, an extension of public sewers to the needs area was laid out for planning and cost development purposes. If this area is selected for sewering, detailed design should be implemented to confirm the approach to extending sewers to this area.

The Wings Cove/ Piney Point area may be served by a system composed gravity sewer lines and low pressure sewer lines, with a new sewer pump station to be located near the intersection of Holly Road and Rogers Drive. As depicted on Figure 5-3 (attached), this area would include installing new sewers on Piney Point Road, Bay Road, Landing Road, Cove Circle, and Holly Road, and parts of Register Road, Rogers Drive, and Point Road. The new pump station would discharge to the sewer line in Creek Road. Based on a preliminary review, downstream capacity in the sewer lines is challenging due to the larger projected flows from this area. In order to address this issue, the proposed work will extend the new force main past the smaller diameter sewer lines on Point Road and discharge to the 10-inch diameter gravity sewer on Creek Road. As noted previously, the Creek Road pump station is in need of replacement (and as of 2021, the replacement has been designed). Due to the large flows for this area, a more detailed downstream analysis will be needed prior to final design of sewer extensions.

For the purposes of assessing nitrogen impacts, this alternative would include transmitting wastewater to the Marion WPCF for treatment and discharge. The WPCF currently treats to a level of 4 mg/l or less of total nitrogen before the discharge of effluent. This is far better than the current nitrogen load from the area from septic systems, which is estimated using an average discharge concentration of 35 mg/l for the existing systems. In the case of the alternative where the area is connected to the Marion WPCF, the

final nitrogen load is also moved from the existing area (contributing to Wings, Blankenship, and Planting Island Coves) to the ultimate receiving water of the WPCF, Aucoot Cove.

Summary of Nitrogen Reduction

Conventional Septic Systems: 29,700 GPD @ 35 mg/l → 8.7 lb/day of N
Marion WPCF Treatment: 29,700 GPD @ 4 mg/l → 1.0lb/day of N

Net Reduction of Nitrogen = 7.7 lb/ day of N (>88% reduction)

The planning level construction costs related to extension of sewers to this area are summarized in Table 5-9.

Table 5-9: Wings Cove/ Piney Point Area Sewer Extension Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	18,000 ft	$5,400,000	-
Low Pressure Sewer	4,800 ft	$960,000	-
Sewer Force Main	10,800 ft	$1,900,000	Partially parallel with new gravity sewer.
Sewer Pump Station	1 PS	$600,000	Site location to be determined in further study.
On-lot Grinder Pumps	34	$340,000	-
Downstream Sewer Improvements	-	-	Lower capacity sewer mains bypassed by longer force main.
Summary	-	$9,200,000	-

Based on the anticipation that the sewer extension to this area would serve approximately 196 unsewered parcels, the average cost per parcel to extend sewers to this area is approximately $47,000 per parcel.

Comparison of Alternatives

The comparison of feasible alternatives for the Wings Cove/ Piney Point area is summarized in Table 5-10.

Table 5-10: Summary of Alternatives for Wings Cove/ Piney Point Needs Area

Alternative	Nitrogen Impacts	Approximate Cost per Parcel	Other Considerations
No-Action	Nitrogen load remains at 9.4 lb/day	Unknown	Individual system actions would likely occur over time, as needed by individual conditions.
Enhanced On-Site Treatment	Nitrogen load reduced to 5.1 lb/day (>45% reduction)	$40,000	Requires additional septic system regulations and enforcement to achieve nitrogen reduction.
Sewer Extension	Nitrogen load reduced to 1.1 lb/day (>88% reduction)	$47,000	

5.1.3.4 Lower Sippican Neck

The Lower Sippican Neck area consists mainly of parcels along the very southern end of Point Road (generally from Howland Road southward). The Kittanset Golf Club comprises a significant portion of this needs area. The suitability of alternatives for this area is summarized in Table 5-11.

Table 5-11: Alternative Screen for Lower Sippican Neck Needs Area

Alternative	Key Factors for Screening	Selected for Further Consideration
No Action	Area is adjacent to multiple surface water; this alternative does not significantly reduce nitrogen impact. Many BOH variances exist in this area, and significant portions lie in the 100-year flood plain	
Enhanced (I/A) Septic Systems	Enhanced on-site treatment may allow for some reduction of nitrogen impacts to waterways.	✓
Localized (Cluster) Treatment	Area is not close to existing sewer system. Smaller area size is conducive to localized treatment	✓
Sewer Extension	Sewer extensions and treatment at the WPCF will provide maximum reduction of pollutant load while utilizing existing treatment facility.	✓

Based on this preliminary screening, three feasible alternatives are considered for this needs area, enhanced on-site treatment, localized (cluster) treatment, and extension of sewers.

Enhanced On-Site Treatment
This alternative would include developing and implementing a program to provide more advanced treatment using on-site systems in the needs area. Based on a preliminary review of the area, the average lot sizes and soil conditions appear to allow the implementation of this alternative in the area.

For the purposes of assessing nitrogen impacts, this report assumes that the area is currently served primarily by fully compliant Title 5 septic systems. Therefore, the current nitrogen load is estimated using an average discharge concentration of 35 mg/l for the existing systems. Under this alternative, a program to improve systems in the needs area over time would be implemented. At the conclusion of such a program, the assumption is that the systems in this area would meet current target levels of optimal nitrogen removal for on-site systems, producing average discharge concentration of 19 mg/l.

Summary of Nitrogen Reduction
Conventional Septic Systems: 5,900 GPD @ 35 mg/l → 1.7 lb/ day of N
Proposed Enhanced Systems: 5,900 GPD @ 19 mg/l → 0.9 lb/ day of N

Net Reduction of Nitrogen = 0.8 lb/ day of N (>45% reduction)

Cost of improvements to septic systems in the area will vary significantly, as the characteristics of individual lots are different. However, for the purposes of cost considerations, this report assumes that each on-site system in the area will eventually need to be upgraded to meet new standards, and that the average cost of these upgrades will be $40,000 or more per system. One advantage of this approach is that the improvements to individual systems can be implemented over a rolling schedule, where parcel upgrade systems on a schedule are more desirable to individual property owners.

Localized (Cluster) Treatment
This alternative would include the design, construction, and operation of a new, localized treatment plant, with its own limited system of sewer lines to collect flows from area properties. The option of localized treatment is complex and presents several challenges – first, the need to find a suitable site for a small treatment system in the area; second, the need for a suitable area to discharge the treated

effluent to the ground; and third, the added complexity of operating an additional treatment facility for the Town's staff. The costs for constructing small treatment systems is significant, but these may be offset by savings from reducing the amount of new sewer needed to connect to Marion's existing sewer system. An additional possible advantage to such a system would be the reduction in treatment flows and loads which need to be treated at the Marion WPCF. Due to the complexities of locating and building a new treatment facility, the details of this alternative should be further evaluated in a detailed, dedicated feasibility study.

For the purposes of assessing nitrogen impacts, this alternative would include treating wastewater at a new localized treatment facility prior to discharge to groundwater. In Massachusetts, all groundwater discharges are required to treat to a level of 10 mg/l or less of total nitrogen before the discharge. This is far better than the current nitrogen load from the area from septic systems, which is estimated using an average discharge concentration of 35 mg/l for the existing systems. Though dependent on final discharge siting, the localized treatment system would likely be tributary to Sippican Harbor, where the nitrogen load from this needs area currently has limited impact on surface waters.

Summary of Nitrogen Reduction

Conventional Septic Systems: 5,900 GPD @ 35 mg/l → 1.7 lb/day of N
Localized Treatment and GWD: 5,900 GPD @ 10 mg/l → 0.5 lb/day of N

Net Reduction of Nitrogen = 1.2 pounds per day of N (>71% reduction)

The planning level construction costs related to implementing localized treatment in this area are summarized in Table 5-12.

Table 5-12: Lower Sippican Neck Area Localized Treatment Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	-	-	None anticipated.
Low Pressure Sewer	6,300 ft	$1,300,000	-
Sewer Force Main	-	-	None anticipated.
Sewer Pump Station	-	-	None anticipated.
On-lot Grinder Pumps	38	$380,000	-
Localized Treatment System	1	$1,400,000	Assumes a suitable site for treatment and groundwater discharge is available.
Summary	-	$3,100,000	-

Based on the anticipation that the localized treatment system would serve approximately 38 unsewered parcels, the average cost per parcel for this option is approximately $82,000 per parcel.

Extension of Public Sewers

The existing sewer system lies far from the Lower Sippican Neck needs area (the nearest sewers to this area are the private Point Road sewer lines, which are insufficiently sized to present any options in sewering this area). Based on a preliminary review, an extension of public sewers to the needs area was

laid out for planning and cost development purposes. If this area is selected for sewering, detailed design should be implemented to confirm the approach to extending sewers to this area.

The Lower Sippican Neck needs area may be served by a system composed primarily of low pressure sewer lines with a new sewer pump station to be located near the intersection of Point Road and Planting Island Road. As depicted on Figure 5-4 (attached), this area would include installing new low pressure sewer along Point Road from the tip of Sippican Neck to the pump station and a force main from the pump station to the existing gravity sewer line at Jenna Drive. Based on a preliminary review, downstream capacity in the sewer lines is believed to exist for the limited flows from this area.

For the purposes of assessing nitrogen impacts, this alternative would include transmitting wastewater to the Marion WPCF for treatment and discharge. The WPCF currently treats to a level of 4 mg/l or less of total nitrogen before the discharge of effluent. This is far better than the current nitrogen load from the area from septic systems, which is estimated using an average discharge concentration of 35 mg/l for the existing systems. In the case of the alternative where the area is connected to the Marion WPCF, the final nitrogen load is also moved from the existing area (contributing to Outer Sippican Harbor and Sedge Cove) to the ultimate receiving water of the WPCF, Aucoot Cove.

Summary of Nitrogen Reduction

Conventional Septic Systems: 5,900 GPD @ 35 mg/l → 1.7 lb/day of N
Marion WPCF Treatment: 5,900 GPD @ 4 mg/l → 0.2 lb/day day of N

Net Reduction of Nitrogen = 1.5 lb/ day of N (>88% reduction)

The planning level construction costs related to extension of sewers to this area are summarized in Table 5-13.

Table 5-13: Lower Sippican Neck Area Sewer Extension Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	-	-	None anticipated.
Low Pressure Sewer	6,300 ft	$1,300,000	-
Sewer Force Main	11,500 ft	$2,300,000	-
Sewer Pump Station	1 PS	$600,000	Site location to be determined in further study.
On-lot Grinder Pumps	38	$380,000	-
Downstream Sewer Improvements	-	-	None anticipated.
Summary	-	$4,600,000	-

Based on the anticipation that the sewer extension to this area would serve approximately 38 unsewered parcels, the average cost per parcel to extend sewers to this area is approximately $120,000 per parcel. Such a significant per parcel cost may be prohibitively expensive. Economies of scale may help control sewer extension costs if adjacent needs areas are sewered together. When extending sewer to the Lower Sippican Neck needs area is considered in conjunction with extending sewer to the Planting

Island and Wings Cove/Piney Point needs areas, the cost to extend sewer is more feasible. Extending sewer to all three of these needs areas together is explored in Section 5.1.3.5, below.

Comparison of Alternatives
The comparison of feasible alternatives for the Lower Sippican Neck area is summarized in Table 5-14.

Table 5-14: Summary of Alternatives for Lower Sippican Neck Needs Area

Alternative	Nitrogen Impacts	Approximate Cost per Parcel	Other Considerations
Enhanced On-Site Treatment	Nitrogen load reduced to 0.9 lb/day (>45% reduction)	$40,000	Requires additional septic system regulations and enforcement to achieve nitrogen reduction.
Localized (Cluster) Treatment	Nitrogen load reduced to 0.5 lb/day (>71% reduction)	$82,000	Extensive study is needed to prove the feasibility of this option.
Sewer Extension	Nitrogen load reduced to 0.2 lb/day (>88% reduction)	$120,000	Could be combined with sewer extensions in other needs areas to decrease per parcel cost.

5.1.3.5 Planting Island

The Planting Island needs area consists of parcels on Planting Island, lying along East Avenue and West Avenue, Planting Island is a peninsula jutting off of the western coast of Sippican Neck, but is densely developed. The suitability of alternatives for this area is summarized in Table 5-15.

Table 5-15: Alternative Screen for Planting Island Needs Area

Alternative	Key Factors for Screening	Selected for Further Consideration
No Action	Area is surrounded by surface waters. This alternative does not significantly reduce nitrogen impact. Small lot sizes and limited separation to waterways, BOH variances, and soil conditions make this area a challenge	
Enhanced (I/A) Septic Systems	Enhanced on-site treatment may allow for some reduction of nitrogen impacts to waterways. Small lot sizes and soil conditions make this area a challenge.	✓ [1]
Localized (Cluster) Treatment	Area is not close to existing sewer system. Smaller area size is conducive to localized treatment.	✓
Sewer Extension	Sewer extensions and treatment at the WPCF will provide maximum reduction of pollutant load while utilizing existing treatment facility.	✓

[1] This alternative will likely encounter significant challenges in this area, but has been carried forward because other alternatives are also challenging, and likely costly.

Based on this preliminary screening, three feasible alternatives are considered for this needs area, enhanced on-site treatment, localized (cluster) treatment, and extension of sewers.

Enhanced On-Site Treatment
This alternative would include developing and implementing a program to provide more advanced treatment using on-site systems in the needs area. Based on a preliminary review of the area, the average lot sizes and soil conditions will present challenges to the implementation of this alternative in the area.

For the purposes of assessing nitrogen impacts, this report assumes that the area is currently served primarily by fully compliant Title 5 septic systems. Therefore, the current nitrogen load is estimated using an average discharge concentration of 35 mg/l for the existing systems. Under this alternative, a program to improve systems in the needs area over time would be implemented. At the conclusion of such a program, the assumption is that the systems in this area would meet current target levels of optimal nitrogen removal for on-site systems, producing average discharge concentration of 19 mg/l.

Summary of Nitrogen Reduction

Conventional Septic Systems: 12,400 GPD @ 35 mg/l → 3.6 lb/ day of N
Proposed Enhanced Systems: 12,400 GPD @ 19 mg/l → 2.0 lb/ day of N

Net Reduction of Nitrogen = 1.6 lb/ day of N (>45% reduction)

Cost of improvements to septic systems in the area will vary significantly, as the characteristics of individual lots are different. However, for the purposes of cost considerations, this report assumes that each on-site system in the area will eventually need to be upgraded to meet new standards. Due to the particularly challenging conditions for siting and constructing these systems on Planting Island, the average cost of these upgrades will be assumed to be $50,000 or more per system. One advantage of this approach is that the improvements to individual systems can be implemented over a rolling schedule, where parcel upgrade systems on a schedule are more desirable to individual property owners.

Localized (Cluster) Treatment

This alternative would include the design, construction, and operation of a new, localized treatment plant, with its own limited system of sewer lines to collect flows from area properties. The option of localized treatment is complex and presents several challenges – first, the need to find a suitable site for a small treatment system in the area; second, the need for a suitable area to discharge the treated effluent to the ground; and third, the added complexity of operating an additional treatment facility for the Town's staff. The costs for constructing small treatment systems is significant, but these may be offset by savings from reducing the amount of new sewer needed to connect to Marion's existing sewer system. An additional possible advantage to such a system would be the reduction in treatment flows and loads which need to be treated at the Marion WPCF. Due to the complexities of locating and building a new treatment facility, the details of this alternative should be further evaluated in a detailed, dedicated feasibility study.

In the case of Planting Island, the localized treatment system would be located off the island, as suitable sites are not available even for review on the island proper. For this analysis, we have assumed that the facility and groundwater discharge system would be located along Point Road, as discussed further below.

For the purposes of assessing nitrogen impacts, this alternative would include treating wastewater at a new localized treatment facility prior to discharge to groundwater. In Massachusetts, all groundwater discharges are required to treat to a level of 10 mg/l or less of total nitrogen before the discharge. This is far better than the current nitrogen load from the area from septic systems, which is estimated using an average discharge concentration of 35 mg/l for the existing systems. Though dependent on final discharge siting, the localized treatment system would likely be tributary to Sippican Harbor, where the nitrogen load from this needs area currently has limited impact on surface waters.

Summary of Nitrogen Reduction

Conventional Septic Systems: 12,400 GPD @ 35 mg/l → 3.6 lb/day of N
Localized Treatment and GWD: 12,400 GPD @ 10 mg/l → 1.0 lb/day of N

Net Reduction of Nitrogen = 2.6 pounds per day of N (>71% reduction)

The planning level construction costs related to implementing localized treatment in this area are summarized in Table 5-16.

Table 5-16: Planting Island Area Localized Treatment Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	-	-	None anticipated.
Low Pressure Sewer	6,200 ft	$1,300,000	-
Sewer Force Main	-	-	None anticipated.
Sewer Pump Station	-	-	None anticipated.
On-lot Grinder Pumps	79	$790,000	-
Localized Treatment System	1	$2,400,000	Assumes a suitable site for treatment and groundwater discharge is available.
Summary	-	$4,500,000	-

Based on the anticipation that the localized treatment system would serve approximately 79 unsewered parcels, the average cost per parcel for this option is approximately $57,000 per parcel.

Extension of Public Sewers

The existing sewer system lies far from the Planting Island needs area (the nearest sewers to this area are the private Point Road sewer lines, which are insufficiently sized to present any options in sewering this area). Based on a preliminary review, an extension of public sewers to the needs area was laid out for planning and cost development purposes. If this area is selected for sewering, detailed design should be implemented to confirm the approach to extending sewers to this area.

The Planting Island needs area may be served by a system composed primarily of low pressure sewer lines, with a new sewer pump station to be located near the intersection of Point Road and Planting Island Road. As depicted on Figure 5-5 (attached), this area would include installing new low pressure sewer along East Avenue, West Avenue, and along Planting Island Road to the pump station. A sewer force main from the pump station would pump along Point Road and discharge to the existing gravity sewer line at Jenna Drive. Based on a preliminary review, downstream capacity in the sewer lines is believed to exist for the limited flows from this area.

For the purposes of assessing nitrogen impacts, this alternative would include transmitting wastewater to the Marion WPCF for treatment and discharge. The WPCF currently treats to a level of 4 mg/l or less of total nitrogen before the discharge of effluent. This is far better than the current nitrogen load from the area from septic systems, which is estimated using an average discharge concentration of 35 mg/l for the existing systems. In the case of the alternative where the area is connected to the Marion WPCF, the

final nitrogen load is also moved from the existing area (contributing to Wing Cove and Outer Sippican Harbor) to the ultimate receiving water of the WPCF, Aucoot Cove.

Summary of Nitrogen Reduction

Conventional Septic Systems: 12,400 GPD @ 35 mg/l → 3.6 lb/day of N
Marion WPCF Treatment:12,400 GPD @ 4 mg/l → 0.4 lb/day day of N

Net Reduction of Nitrogen = 3.2 lb/ day of N (>88% reduction)

The planning level construction costs related to extension of sewers to this area are summarized in Table 5-17.

Table 5-17: Planting Island Area Sewer Extension Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	-	-	None anticipated.
Low Pressure Sewer	6,200 ft	$1,300,000	-
Sewer Force Main	11,500 ft	$2,300,000	-
Sewer Pump Station	1 PS	$600,000	Site location to be determined in further study.
On-lot Grinder Pumps	79	$790,000	-
Downstream Sewer Improvements	-	-	None anticipated.
Summary	-	$5,000,000	-

Based on the anticipation that the sewer extension to this area would serve approximately 79 unsewered parcels, the average cost per parcel to extend sewers to this area is approximately $63,000 per parcel. Economies of scale may help control sewer extension costs if adjacent needs areas are sewered together. When extending sewer to the Planting Island needs area is considered in conjunction with extending sewer to the Lower Sippican Neck and Wings Cove/Piney Point needs areas, the cost to extend sewers is more feasible. Extending sewer to all three of these needs areas together is explored at the end of this section.

Comparison of Alternatives

The comparison of feasible alternatives for the Planting Island area is summarized in Table 5-18.

Table 5-18: Summary of Alternatives for Planting Island Needs Area

Alternative	Nitrogen Impacts	Approximate Cost per Parcel	Other Considerations
Enhanced On-Site Treatment	Nitrogen load reduced to 2.0 lb/day (>45% reduction)	$50,000	Requires additional septic system regulations and enforcement to achieve nitrogen reduction.
Localized (Cluster) Treatment	Nitrogen load reduced to 1.0 lb/day (>71% reduction)	$57,000	Extensive study is needed to prove the feasibility of this option.
Sewer Extension	Nitrogen load reduced to 0.4 lb/day (>88% reduction)	$63,000	Could be combined with sewer extensions in other needs areas to decrease per parcel cost.

Sewer Extensions to the Planting Island Area in Combination with Lower Sippican Neck and Wings Cove/Piney Point Needs Areas

Due to the distance between these needs areas and the existing sewer system, sewer extensions are less cost effective (on a per property basis) for smaller areas. When sewers are extended to either the Planting Island area or the Lower Sippican Neck area independently, costs per parcel are very high. However, when all of the Planting Island, Lower Sippican Neck, and Wings Cove/Piney Point Needs Areas are sewered, the per parcel cost can be reduced by sharing infrastructure (particularly pump stations and force mains) and the associated costs.

In this case, each needs area would generally be sewered as described in their preceding sections above (Sections 5.1.3.3 through 5.1.3.5), but the main pump station would be located in the Wings Cove/Piney Point area (for planning purposes near the intersection of Rogers Drive and Holly Road). As described for the Wings Cove/Piney Point area, the new force main would extend along Point Road from the pump station to the existing sewer in Creek Road. In addition to the improvements described for these areas, some additional low pressure sewer would be required to connect the Planting Island and Lower Sippican Neck area pressure sewers to the sewer system in the Wings Cove/Piney Point area. This system is depicted in Figure 5-6 (attached).

Based on a preliminary review, downstream capacity in the sewer lines is challenging due to the larger projected flows from these areas. In order to address this issue, the area would propose to extend the new force main past the smaller diameter sewer lines on Point Road and discharge to the 10-inch diameter gravity sewer on Creek Road. As noted previously, the Creek Road pump station is in need of replacement (and as of 2021, the replacement has been designed). Due to the large flows for these areas, a more detailed downstream analysis will be needed prior to final design of sewer extensions.

The planning level construction costs related to extension of sewers to these areas together are summarized in Table 5-19.

Table 5-19: Combined Planting Island, Lower Sippican Neck and Wings Cove/Piney Point Areas Sewer Extension Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	18,000 ft	$5,400,000	-
Low Pressure Sewer	19,000 ft	$3,800,000	-
Sewer Force Main	12,300 ft	$2,300,000	Partially parallel with new gravity sewer.
Sewer Pump Station	1 PS	$600,000	Site location to be determined in further study.
On-lot Grinder Pumps	151	$1,500,000	-
Downstream Sewer Improvements	-	-	Lower capacity sewer mains bypassed by longer force main.
Summary	-	$13,600,000	-

When combined across 313 parcels, the approximate cost per parcel in a combined Planting Island, Lower Sippican Neck, Wings Cove/Piney Point needs area is approximately $44,000. Table 5-20

compares the relative costs of each of these needs areas when sewered individually and when sewered together.

Table 5-20: Cost Comparison of Sewer Extensions to Combined Sewering of Needs Areas

Needs Area	Approximate Cost per Parcel
Wings Cove/ Piney Point	$47,000
Lower Sippican Neck	$120,000
Planting Island	$63,000
Combined Areas	$44,000

Localized Treatment for Planting Island in Combination with Lower Sippican Neck Needs Area
Similar to the economies of scale achievable by combining areas when extending public sewers, the implementation of a localized treatment option for adjacent areas may have advantages. In the case of Planting Island and the adjacent Lower Sippican Neck area, these advantages are significant. Unlike the sewer extensions, this combination of areas does not work better when adding the larger Wings Cove/Piney Point area to the localized treatment option. This is due to the much larger flows from that larger Wings Cove/ Piney Point needs area, which drives up the size of the localized treatment system, and thereby also makes the system harder to site in the area. For this combined alternative, we therefore consider here a single localized treatment system that would serve both the Planting Island area and the Lower Sippican Neck area.

As with the individual discussions for Planting Island and Lower Sippican Neck, the localized treatment system would likely be located along Point Road, somewhere near its intersection with Planting Island Road. For the purposes of assessing nitrogen impacts, this alternative would include treating wastewater at a new localized treatment facility prior to discharge to groundwater. In Massachusetts, all groundwater discharges are required to treat to a level of 10 mg/l or less of total nitrogen before the discharge. This is far better than the current nitrogen load from the area from existing septic systems (which is estimated using an average discharge concentration of 35 mg/l). Though dependent on final discharge siting, the localized treatment system would likely be tributary to the outer Sippican Harbor, where the nitrogen load from this needs area currently has limited impact on surface waters.

Summary of Nitrogen Reduction

Conventional Septic Systems: 18,300 GPD @ 35 mg/l → 5.3 lb/day of N
Localized Treatment and GWD: 18,300 GPD @ 10 mg/l → 1.5 lb/day of N

Net Reduction of Nitrogen = 3.8 pounds per day of N (>71% reduction)

The planning level construction costs related to implementing localized treatment for these combined areas are summarized in Table 5-21.

Table 5-21: Combined Planting Island and Lower Sippican Neck Area Localized Treatment Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	-	-	None anticipated.
Low Pressure Sewer	12,500 ft	$2,500,000	-
Sewer Force Main	-	-	None anticipated.
Sewer Pump Station	-	-	None anticipated.
On-lot Grinder Pumps	117	$1,200,000	-
Localized Treatment System	1	$3,300,000	Assumes a suitable site for treatment and groundwater discharge is available.
Summary	-	$7,000,000	-

When combined across 117 parcels, the approximate cost per parcel for a combined localized treatment option serving Planting Island, and Lower Sippican Neck needs area is approximately $60,000. This is a similar cost to treating Planting Island alone, but represents a per parcel savings compared to the cost for the smaller Lower Sippican Neck area.

5.1.3.6 Allens Point/ Harbor East

The Allens Point/ Harbor East area consists mainly of properties on Allens Point adjacent to the Inner Sippican Harbor and Blankenship Cove. The suitability of alternatives for this area is summarized in Table 5-22.

Table 5-22: Alternative Screen for Allens Point/ Harbor East Needs Area

Alternative	Key Factors for Screening	Selected for Further Consideration
No Action	Area is adjacent to impaired waters. This alternative does not significantly reduce nitrogen impact. Lot sizes are large and there are few BOH variances.	✓
Enhanced (I/A) Septic Systems	Enhanced on-site treatment may allow for some reduction of nitrogen impacts to waterways.	✓
Localized (Cluster) Treatment	Area is close to existing sewer system, making sewer extension more feasible than localized treatment.	
Sewer Extension	Existing system is close to the needs area and will provide maximum reduction of pollutant load.	✓

Based on this preliminary screening, three feasible alternatives are considered for this needs area – no action, enhanced on-site treatment, and extension of sewers.

No Action

This alternative requires no significant action or change by the Town, and on-site systems may continue to be used. Responsibility for maintaining each septic system remains solely with the individual property owner. This includes compliance with all current regulations, including the *Septic System Denitrification Regulation* which requires that denitrification systems be installed for new systems and replacement of nonconforming failed systems at the time of transfer. This regulation will likely lead to a reduction of nitrogen from septic systems, though occurring over a long (indeterminate) time period.

Enhanced On-Site Treatment

This alternative would include developing and implementing a program to provide more advanced treatment using on-site systems in the needs area. Based on a preliminary review of the area, the average lot sizes and soil conditions appear to allow the implementation of this alternative in the area.

For the purposes of assessing nitrogen impacts, this report assumes that the area is currently served primarily by fully compliant Title 5 septic systems. Therefore, the current nitrogen load is estimated using an average discharge concentration of 35 mg/l for the existing systems. Under this alternative, a program to improve systems in the needs area over time would be implemented. At the conclusion of such a program, the assumption is that the systems in this area would meet current target levels of optimal nitrogen removal for on-site systems, producing average discharge concentration of 19 mg/l.

Summary of Nitrogen Reduction

Conventional Septic Systems: 4,800 GPD @ 35 mg/l → 1.4 lb/ day of N
Proposed Enhanced Systems: 4,800 GPD @ 19 mg/l → 0.8 lb/ day of N

Net Reduction of Nitrogen = 0.6 pounds per day of N (>45% reduction)

Cost of improvements to septic systems in the area will vary significantly, as the characteristics of individual lots are different. However, for the purposes of cost considerations, this report assumes that each on-site system in the area will eventually need to be upgraded to meet new standards, and that the average cost of these upgrades will be $40,000 or more per system. One advantage of this approach is that the improvements to individual systems can be implemented over a rolling schedule, where parcel upgrade systems on a schedule are more desirable to individual property owners.

Extension of Public Sewers

While existing sewer lines are relatively close to the Allens Point/ Harbor East needs area, the lines in Point Road are privately owned and not suitable for connection of this area. The sewers to serve this area should be planned to be extended to the existing gravity sewer line near the intersection of Jenna Drive. Based on a preliminary review, an extension of public sewers to the needs area was laid out for planning and cost development purposes. If this area is selected for sewering, detailed design should be implemented to confirm the approach to extending sewers to this area.

The Allens Point/ Harbor East needs area may be served by a system composed primarily of low pressure sewer lines. As depicted on Figure 5-7 (attached), this area would include installing new sewers on West Drive and Allens Point Road, and bypassing a small portion of privately-owned low pressure sewer on Point Road from Allen's Point Road to the intersection of Jenna Drive. The area will ultimately connect to the existing gravity sewer on Point Road near Jenna Drive. Based on a preliminary review, downstream capacity in the sewer lines is believed to exist for the limited flows from this area.

For the purposes of assessing nitrogen impacts, this alternative would include transmitting wastewater to the Marion WPCF for treatment and discharge. The WPCF currently treats to a level of 4 mg/l or less of total nitrogen before the discharge of effluent. This is far better than the current nitrogen load from the area from septic systems, which is estimated using an average discharge concentration of 35 mg/l for the existing systems. In the case of the alternative where the area is connected to the Marion WPCF, the final nitrogen load is also moved from the existing area (contributing to the Wings Cove and Inner Sippican Harbor) to the ultimate receiving water of the WPCF, Aucoot Cove.

Summary of Nitrogen Reduction

Conventional Septic Systems: 4,800 GPD @ 35 mg/l → 1.4 lb/day of N
Marion WPCF Treatment 4,800 GPD @ 4 mg/l → 0.2 lb/day of N

Net Reduction of Nitrogen = 1.2 pounds per day of N (>88% reduction)

The planning level construction costs related to extension of sewers to this area are summarized in Table 5-23.

Table 5-23: Allens Point/Harbor East River Area Sewer Extension Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	-	-	None anticipated.
Low Pressure Sewer	8,000 ft	$1,600,000	-
Sewer Force Main	-	-	None anticipated.
Sewer Pump Station	-	-	None anticipated.
On-lot Grinder Pumps	34	$340,000	-
Downstream Sewer Improvements	1,000 ft	$200,000	Bypass existing LP sewer along Point Road with new LP from Allens Point Road to Jenna Drive.
Summary	-	$2,100,000	-

Based on the anticipation that the sewer extension to this area would serve approximately 34 unsewered parcels, the average cost per parcel to extend sewers to this area is approximately $63,000 per parcel.

In early 2021, the Town was approached by residents within this planning area who live along West Drive and North Drive about connecting seven homes in this area to the sewer system. The review and implementation of this possible sewer extension is still in process, but if approved and constructed, this 'private' sewer extension would address a number of on-site system concerns and ultimately would reduce the size of the remaining planning area.

Comparison of Alternatives

The comparison of feasible alternatives for the Allens Point/ Harbor East area is summarized in Table 5-24.

Table 5-24: Summary of Alternatives for Allens Point/ Harbor East River Needs Area

Alternative	Nitrogen Impacts	Approximate Cost per Parcel	Other Advantages
No-Action	Nitrogen load remains at 1.6 lb/day	Unknown	Individual system actions would likely occur over time, as needed by individual conditions.
Enhanced On-Site Treatment	Nitrogen load reduced to 0.9 lb/day (>45% reduction)	$40,000	Requires additional septic system regulations and enforcement to achieve nitrogen reduction.
Sewer Extension	Nitrogen load reduced to 0.2 lb/day (>88% reduction)	$63,000	

5.1.3.7 Converse Point

The Converse Point area consists of properties along the Moorings Road on Converse Point. This area on the lower peninsula is a private road area and accessed by a 'gate' at the southern end of Converse Road. The suitability of alternatives for this area are summarized in Table 5-25.

Table 5-25: Alternative Screen for Converse Point Needs Area

Alternative	Key Factors for Screening	Selected for Further Consideration
No Action	Area is adjacent to multiple surface waters with no known impairments. This alternative does not significantly reduce nitrogen impacts. Large lot sizes, few BOH variances, and a significant portion in the 100-year flood zone.	✓
Enhanced (I/A) Septic Systems	Enhanced on-site treatment may allow for some reduction of nitrogen impacts to waterways.	✓
Localized (Cluster) Treatment	Area is close to existing sewer system, making sewer extension more feasible than localized treatment.	
Sewer Extension	Existing system is close to the needs area, and will provide maximum reduction of pollutant load.	✓

Based on this preliminary screening, three feasible alternatives are considered for this needs area – no action, enhanced on-site treatment, and extension of sewers.

No Action

This alternative requires no significant action or change by the Town, and on-site systems may continue to be used. Responsibility for maintaining each septic system remains solely with the individual property owner. This includes compliance with all current regulations, including the *Septic System Denitrification Regulation* which requires that denitrification systems be installed for new systems and replacement of nonconforming failed systems at the time of transfer. This regulation will likely lead to a reduction of nitrogen from septic systems, though occurring over a long (indeterminate) time period.

Enhanced On-Site Treatment

This alternative would include developing and implementing a program to provide more advanced treatment using on-site systems in the needs area. Based on a preliminary review of the area, the average lot sizes and soil conditions appear to allow the implementation of this alternative in the area.

For the purposes of assessing nitrogen impacts, this report assumes that the area is currently served primarily by fully compliant Title 5 septic systems. Therefore, the current nitrogen load is estimated using an average discharge concentration of 35 mg/l for the existing systems. Under this alternative, a program to improve systems in the needs area over time would be implemented. At the conclusion of such a program, the assumption is that the systems in this area would meet current target levels of optimal nitrogen removal for on-site systems, producing average discharge concentration of 19 mg/l.

Summary of Nitrogen Reduction

Conventional Septic Systems: 3,800 GPD @ 35 mg/l → 1.1 lb/ day of N
Proposed Enhanced Systems: 3,800 GPD @ 19 mg/l → 0.6 lb/ day of N

Net Reduction of Nitrogen = 0.5 pounds per day of N (>45% reduction)

Cost of improvements to septic systems in the area will vary significantly, as the characteristics of individual lots are different. However, for the purposes of cost considerations, this report assumes that each on-site system in the area will eventually need to be upgraded to meet new standards, and that the average cost of these upgrades will be $40,000 or more per system. One advantage of this approach is that the improvements to individual systems can be implemented over a rolling schedule, where parcel upgrade systems on a schedule are more desirable to individual property owners.

Extension of Public Sewers

The existing sewer system on Converse Road lies in relatively close proximity to the Converse Point needs area. Based on a preliminary review, an extension of public sewers to the needs area was laid out for planning and cost development purposes. If this area is selected for sewering, detailed design should be implemented to confirm the approach to extending sewers to this area.

Based on a request from two homeowners in the Moorings area to connect to the sewer system, an evaluation of the ability and approach to connecting this area to sewers was completed in early 2021. This included reviewing the capacity of existing low pressure sewer lines in Converse Road, which confirmed that parts of the existing system would need to be increased in size to accommodate the Moorings (Converse Point area).

The Converse Point needs area may be served by a low pressure sewer line. As depicted on Figure 5-8 (attached), this area would include installing new sewer on Moorings Road and replacement of the existing low pressure sewers on Converse Road from Moorings Road to Reservation Way. The area would ultimately discharge to the existing sewer main on Converse Road. Based on the completed capacity review, downstream capacity in the existing sewer lines above Reservation Way is believed to exist for the flows from this area.

For the purposes of assessing nitrogen impacts, this alternative would include transmitting wastewater to the Marion WPCF for treatment and discharge. The WPCF currently treats to a level of 4 mg/l or less of total nitrogen before the discharge of effluent. This is far better than the current nitrogen load from the area from septic systems, which is estimated using an average discharge concentration of 35 mg/l for the existing systems. In the case of the alternative where the area is connected to the Marion WPCF, some of the final nitrogen load is also moved from the eastern side of the existing area (contributing to Outer Sippican Harbor) to the ultimate receiving water of the WPCF, Aucoot Cove. However, that movement still results in a net reduction of total nitrogen loadings to Aucoot Cove.

Summary of Nitrogen Reduction

Conventional Septic Systems: 3,800 GPD @ 35 mg/l → 1.1 lb/day of N
Marion WPCF Treatment 3,800 GPD @ 4 mg/l → 0.1 lb/day of N

Net Reduction of Nitrogen = 1.0 pounds per day of N (>88% reduction)

The planning level construction costs related to extension of sewers to this area are summarized in Table 5-26.

Table 5-26: Converse Point Sewer Extension Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	-	-	None anticipated.
Low Pressure Sewer	3,000 ft	$600,000	-
Sewer Force Main	-	-	None anticipated.
Sewer Pump Station	-	-	None anticipated.
On-lot Grinder Pumps	26	$260,000	-
Downstream Sewer Improvements	2,600 ft	$520,000	Replace existing 2" LP sewer along Converse Road with 3" LP from gate at Moorings Road to Reservation Way.
Summary	-	$1,400,000	-

Based on the anticipation that the sewer extension to this area would serve approximately 26 unsewered parcels, the average cost per parcel to extend sewers to this area is approximately $54,000 per parcel.

Comparison of Alternatives

The comparison of feasible alternatives for the Converse Point area is summarized in Table 5-27.

Table 5-27: Summary of Alternatives for Converse Point Needs Area

Alternative	Nitrogen Impacts	Approximate Cost per Parcel	Other Considerations
No-Action	Nitrogen load remains at 1.1 lb/day	$0	Individual system actions would likely occur over time, as needed by individual conditions.
Enhanced On-Site Treatment	Nitrogen load reduced to 0.6 lb/day (>45% reduction)	$40,000	Requires additional septic system regulations and enforcement to achieve nitrogen reduction.
Sewer Extension	Nitrogen load reduced to 0.1 lb/day (>88% reduction)	$54,000	

5.1.3.8 Aucoot Creek

The Aucoot Creek area consists mainly of properties along either side of Mill Street to the border with Mattapoisett and along Aucoot Creek. This area is also nominally referred to as the Indian Cove Road area, as homes along Indian Cove Road comprise a large part of the service area. The suitability of alternatives for this area is summarized in Table 5-28.

Table 5-28: Alternative Screen for Aucoot Creek Needs Area

Alternative	Key Factors for Screening	Selected for Further Consideration
No Action	Area is adjacent to impaired waters. This alternative does not significantly reduce nitrogen impact.	
Enhanced (I/A) Septic Systems	Enhanced on-site treatment may allow for some reduction of nitrogen impacts to waterways.	✓
Localized (Cluster) Treatment	Area is not prohibitively far from existing sewer system, making sewer extension more feasible than localized treatment.	
Sewer Extension	Existing system will provide maximum reduction of pollutant load.	✓

Based on this preliminary screening, two feasible alternatives are considered for this needs area – on-site treatment and extension of sewers.

Enhanced On-Site Treatment
This alternative would include developing and implementing a program to provide more advanced treatment using on-site systems in the needs area. Based on a preliminary review of the area, the average lot sizes and soil conditions appear to allow the implementation of this alternative in the area.

For the purposes of assessing nitrogen impacts, this report assumes that the area is currently served primarily by fully compliant Title 5 septic systems. Therefore, the current nitrogen load is estimated using an average discharge concentration of 35 mg/l for the existing systems. Under this alternative, a program to improve systems in the needs area over time would be implemented. At the conclusion of such a program, the assumption is that the systems in this area would meet current target levels of optimal nitrogen removal for on-site systems, producing average discharge concentration of 19 mg/l.

Summary of Nitrogen Reduction

Conventional Septic Systems: 6,800 GPD @ 35 mg/l → 2.0 lb/ day of N
Proposed Enhanced Systems: 6,800 GPD @ 19 mg/l → 1.1 lb/ day of N

Net Reduction of Nitrogen = 0.9 pounds per day of N (>45% reduction)

Cost of improvements to septic systems in the area will vary significantly, as the characteristics of individual lots are different. However, for the purposes of cost considerations, this report assumes that each on-site system in the area will eventually need to be upgraded to meet new standards, and that the average cost of these upgrades will be $40,000 or more per system. One advantage of this approach is that the improvements to individual systems can be implemented over a rolling schedule, where parcel upgrade systems on a schedule are more desirable to individual property owners.

Extension of Public Sewers
The existing sewer system lies relatively distant from the Aucoot Creek needs area. Based on a preliminary review, an extension of public sewers to the needs area was laid out for planning and cost development purposes. If this area is selected for sewering, detailed design should be implemented to confirm the approach to extending sewers to this area.

The Aucoot Creek needs area may be served by a system composed primarily of low pressure sewer lines with a new sewer pump station to be located near the intersection of Rocky Knook Lane and Mill Street. As depicted on Figure 5-9 (attached), this area would include installing new sewers on Rocky Knook Lane, Holly Pond Road, Indian Cove Road, Alden Road, and Sassamon Trail, as well as the portion of Mill Street from Indian Cove Road to the pump station. A new force main would run along Mill Street from the proposed pump station and join the Front Street PS force main at Benson Brook Road, ultimately discharging to the WPCF.

For the purposes of assessing nitrogen impacts, this alternative would include transmitting wastewater to the Marion WPCF for treatment and discharge. The WPCF currently treats to a level of 4 mg/l or less of total nitrogen before the discharge of effluent. This is far better than the current nitrogen load from the area from septic systems, which is estimated using an average discharge concentration of 35 mg/l for the existing systems. In the case of the alternative where the area is connected to the Marion WPCF, the final nitrogen load reduction would be within the receiving water of the WPCF, Aucoot Cove.

Summary of Nitrogen Reduction

Conventional Septic Systems: 6,800 GPD @ 35 mg/l → 2.0 lb/day of N
Marion WPCF Treatment 6,800 GPD @ 4 mg/l → 0.2 lb/day of N

Net Reduction of Nitrogen = 1.8 pounds per day of N (>88% reduction)

The planning level construction costs related to extension of sewers to this area are summarized in Table 5-29.

Table 5-29: Aucoot Creek Sewer Extension Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	-	-	None anticipated.
Low Pressure Sewer	9,300 ft	$1,900,000	-
Sewer Force Main	8,300 ft	$1,700,000	-
Sewer Pump Station	1PS	$600,000	Site location to be determined in further study.
On-lot Grinder Pumps	44	$440,000	-
Downstream Sewer Improvements	-	-	None anticipated.
Summary	-	$4,600,000	-

Based on the anticipation that the sewer extension to this area would serve approximately 44 unsewered parcels, the average cost per parcel to extend sewers to this area is approximately $104,000 per parcel. Such a significant per parcel cost may be prohibitively expensive. When extending sewer to the Aucoot Creek needs area is considered in conjunction with extending sewer to the Lower Mill Street needs area, the cost to extend sewer is more feasible. Extending sewer to both of these needs areas is explored in Section 5.1.3.9, below.

Comparison of Alternatives

The comparison of feasible alternatives for the Aucoot Creek area is summarized in Table 5-30.

Table 5-30: Summary of Alternatives for Aucoot Creek Needs Area

Alternative	Nitrogen Impacts	Approximate Cost per Parcel	Other Advantages
Enhanced On-Site Treatment	Nitrogen load reduced to 1.1 lb/day (>45% reduction)	$40,000	Requires additional septic system regulations and enforcement to achieve nitrogen reduction.
Sewer Extension	Nitrogen load reduced to 0.2 lb/day (>88% reduction)	$104,000	Could be combined with sewer extensions in other needs areas to decrease per parcel cost.

5.1.3.9 Lower Mill Street

The Lower Mill Street area consists mainly of properties along the Mill Street from Converse Road to Rocky Knook Lane. The suitability of alternatives for this area is summarized in Table 5-31.

Table 5-31: Alternative Screen for Lower Mill Street Needs Area

Alternative	Key Factors for Screening	Selected for Further Consideration
No Action	This alternative does not significantly reduce nitrogen impact.	
Enhanced (I/A) Septic Systems	Enhanced on-site treatment may allow for some reduction of nitrogen impacts to waterways.	✓
Localized (Cluster) Treatment	Area is not prohibitively far from existing sewer system, making sewer extension more feasible than localized treatment.	
Sewer Extension	Existing system is close to the needs area and will provide maximum reduction of pollutant load.	✓

Based on this preliminary screening, two feasible alternatives are considered for this needs area – enhanced on-site treatment, and extension of sewers.

Enhanced On-Site Treatment

This alternative would include developing and implementing a program to provide more advanced treatment using on-site systems in the needs area. Based on a preliminary review of the area, the average lot sizes and soil conditions appear to allow the implementation of this alternative in the area.

For the purposes of assessing nitrogen impacts, this report assumes that the area is currently served primarily by fully compliant Title 5 septic systems. Therefore, the current nitrogen load is estimated using an average discharge concentration of 35 mg/l for the existing systems. Under this alternative, a program to improve systems in the needs area over time would be implemented. At the conclusion of such a program, the assumption is that the systems in this area would meet current target levels of optimal nitrogen removal for on-site systems, producing average discharge concentration of 19 mg/l.

Summary of Nitrogen Reduction

Conventional Septic Systems: 17,200 GPD @ 35 mg/l → 5.0 lb/ day of N
Proposed Enhanced Systems: 17,200 GPD @ 19 mg/l → 2.7 lb/ day of N

Net Reduction of Nitrogen = 2.3 lb/day of N (>45% reduction)

Cost of improvements to septic systems in the area will vary significantly, as the characteristics of individual lots are different. However, for the purposes of cost considerations, this report assumes that each on-site system in the area will eventually need to be upgraded to meet new standards, and that the average cost of these upgrades will be $40,000 or more per system. One advantage of this approach is that the improvements to individual systems can be implemented over a rolling schedule, where parcel upgrade systems on a schedule are more desirable to individual property owners.

Extension of Public Sewers

The existing sewer system lies in relatively close proximity to the Lower Mill Street needs area. Based on a preliminary review, an extension of public sewers to the needs area was laid out for planning and cost development purposes. If this area is selected for sewering, detailed design should be implemented to confirm the approach to extending sewers to this area.

The Lower Mill Street needs area may be served by a mixed system of gravity and low pressure sewer lines with a new sewer pump station to be located just north of the intersection of Mill Street and Abels Way. As depicted on Figure 5-10 (attached), this area would include installing new low pressure sewers on Parlowtown Road, Sparrow Lane, and a portion of Mill Street. New gravity sewers would be constructed on Old Indian Trail, Giffords Corner Road, Abels Way, and portions of Converse Road and Mill Street. A new force main would run along Mill Street from the proposed pump station and join the Front Street PS force main at Benson Brook Road, ultimately discharging to the WPCF.

For the purposes of assessing nitrogen impacts, this alternative would include transmitting wastewater to the Marion WPCF for treatment and discharge. The WPCF currently treats to a level of 4 mg/l or less of total nitrogen before the discharge of effluent. This is far better than the current nitrogen load from the area from septic systems, which is estimated using an average discharge concentration of 35 mg/l for the existing systems.

Summary of Nitrogen Reduction

Conventional Septic Systems: 17,200 GPD @ 35 mg/l → 5.0 lb/day of N
Marion WPCF Treatment 17,200 GPD @ 4 mg/l → 0.6 lb/day of N

Net Reduction of Nitrogen = 4.4 pounds per day of N (>88% reduction)

The planning level construction costs related to extension of sewers to this area are summarized in Table 5-32.

Table 5-32: Lower Mill Street Sewer Extension Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	8,700 ft	$2,600,000	-
Low Pressure Sewer	2,900 ft	$580,000	-
Sewer Force Main	4,500 ft	$700,000	Portion of FM runs parallel to gravity sewer.
Sewer Pump Station	1 PS	$600,000	Site location to be determined in further study.
On-lot Grinder Pumps	26	$260,000	For parcels connected to LP sewer only.
Downstream Sewer Improvements	-	-	None anticipated.
Summary	-	$4,700,000	-

Based on the anticipation that the sewer extension to this area would serve approximately 111 unsewered parcels, the average cost per parcel to extend sewers to this area is approximately $42,000 per parcel. When extending sewer to the Aucoot Creek needs area is considered in conjunction with extending sewer to the Lower Mill Street needs area, the cost to extend sewer is more feasible. Extending sewer to both of these needs areas is explored at the end of this section.

Comparison of Alternatives
The comparison of feasible alternatives for the Lower Mill Street area is summarized in Table 5-33.

Table 5-33: Summary of Alternatives for Lower Mill Street Needs Area

Alternative	Nitrogen Impacts	Approximate Cost per Parcel	Other Advantages
Enhanced On-Site Treatment	Nitrogen load reduced to 0.6 lb/day (>45% reduction)	$40,000	Requires additional septic system regulations and enforcement to achieve nitrogen reduction.
Sewer Extension	Nitrogen load reduced to 0.1 lb/day (>88% reduction)	$42,000	Could be combined with sewer extensions in other needs areas to decrease per parcel cost.

Sewer Extensions to the Lower Mill Street Area in Combination with the Aucoot Creek Needs Area
The possibility exists to consider sewering the Aucoot Creek area simultaneously with the Lower Mill Street area. Such an approach is expected to be more cost effective than extending sewers to either needs area independently. When all of the Aucoot Creek and Lower Mill Street Needs Areas are sewered in combination, the per parcel cost can be reduced by sharing infrastructure (particularly pump stations and force mains) and associated costs.

In this case, each needs area would be sewered as described in their preceding sections above (Sections 5.1.3.8 through 5.1.3.9), but the single pump station would be located just north of the intersection of Mill Street and Abels Way. In addition to the improvements described for these areas, a small segment of additional low pressure sewer would be required to connect the two areas on Mill Street. This is depicted in Figure 5-11 (attached).

The planning level construction costs related to extension of sewers to these areas together are summarized in Table 5-34.

Table 5-34: Combined Lower Mill Street and Aucoot Creek Areas
Sewer Extension Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	8,700 ft	$2,600,000	-
Low Pressure Sewer	12,200 ft	$2,400,000	-
Sewer Force Main	4,500 ft	$700,000	Portion of FM runs parallel to gravity sewer.
Sewer Pump Station	1	$600,000	Site location to be determined in further study.
On-lot Grinder Pumps	70	$700,000	For parcels connected to LP sewer only.
Downstream Sewer Improvements	-	-	None anticipated.
Summary	-	$7,000,000	-

When combined across 155 parcels, the approximate cost per parcel in a combined Aucoot Creek and Lower Mill Street needs area is $45,000. Table 5-35 compares the costs of each of these needs areas when sewered individually versus being sewered together.

Table 5-35: Cost Comparison of Sewer Extensions to Combined Needs Areas

Needs Area	Approximate Cost per Parcel
Aucoot Creek	$104,000
Lower Mill Street	$42,000
Combined	$45,000

5.1.3.10 Upper Front Street

The Upper Front Street area consists mainly of properties along Front Street west of I-195. The suitability of alternatives for this area is summarized in Table 5-36.

Table 5-36: Alternative Screen for Upper Front Street Needs Area

Alternative	Key Factors for Screening	Selected for Further Consideration
No Action	Area is adjacent to the Sippican River which is not impaired for nitrogen, but is also near the Town's drinking water wells.	✓
Enhanced (I/A) Septic Systems	Enhanced on-site treatment may allow for some reduction of nitrogen impacts to waterways, and offer enhanced protection of groundwater.	✓
Localized (Cluster) Treatment	Area is close to existing sewer system, making sewer extension more feasible than localized treatment.	
Sewer Extension	Existing system is close to the needs area and will provide maximum reduction of pollutant load.	✓

Based on this preliminary screening, three feasible alternatives are considered for this needs area – no action, enhanced on-site treatment and extension of sewers.

No Action

This alternative requires no significant action or change by the Town, and on-site systems may continue to be used. Responsibility for maintaining each septic system remains solely with the individual property owner. This includes compliance with all current regulations, including the *Septic System Denitrification Regulation* which requires that denitrification systems be installed for new systems and replacement of nonconforming failed systems at the time of transfer. This regulation will likely lead to a reduction of nitrogen from septic systems, though occurring over a long (indeterminate) time period.

Enhanced On-Site Treatment

This alternative would include developing and implementing a program to provide more advanced treatment using on-site systems in the needs area. Based on a preliminary review of the area, the average lot sizes and soil conditions appear to allow the implementation of this alternative in the area.

For the purposes of assessing nitrogen impacts, this report assumes that the area is currently served

primarily by fully compliant Title 5 septic systems. Therefore, the current nitrogen load is estimated using an average discharge concentration of 35 mg/l for the existing systems. Under this alternative, a program to improve systems in the needs area over time would be implemented. At the conclusion of such a program, the assumption is that the systems in this area would meet current target levels of optimal nitrogen removal for on-site systems, producing average discharge concentration of 19 mg/l.

Summary of Nitrogen Reduction

Conventional Septic Systems: 15,800 GPD @ 35 mg/l → 4.6 lb/ day of N
Proposed Enhanced Systems: 15,800 GPD @ 19 mg/l → 2.5 lb/ day of N

Net Reduction of Nitrogen = 2.1 pounds per day of N (>45% reduction)

Cost of improvements to septic systems in the area will vary significantly, as the characteristics of individual lots are different. However, for the purposes of cost considerations, this report assumes that each on-site system in the area will eventually need to be upgraded to meet new standards, and that the average cost of these upgrades will be $40,000 or more per system. One advantage of this approach is that the improvements to individual systems can be implemented over a rolling schedule, where parcel upgrade systems on a schedule are more desirable to individual property owners.

Extension of Public Sewers

The existing sewer system includes low pressure sewer lines serving Front Street as far north as the intersection of Briggs Terrace, which is adjacent to the Upper Front Street needs area. Based on a preliminary review, an extension of public sewers to the needs area was laid out for planning and cost development purposes. If this area is selected for sewering, detailed design should be implemented to confirm the approach to extending sewers to this area.

The Upper Front Street needs area may be served by a system composed of low pressure sewer lines. As depicted on Figure 5-12 (attached), this area would include installing new sewers on Brook Haven Lane, Ichabod Lane, Pinewood Drive, Quails Crossing, Partridge Place, Thomas Lane, and a portion of Front Street. The existing low pressure sewer line in Front Street between Briggs Terrace and Cranberry Way is too small to accommodate the flows from this service area, so the new low pressure sewers in Front Street would extend past that area, and ultimately connect to the existing low pressure sewer main on Front Street at Cranberry Way. Based on a preliminary review, downstream capacity in the sewer lines below this area is believed to exist for the flows from this area.

For the purposes of assessing nitrogen impacts, this alternative would include transmitting wastewater to the Marion WPCF for treatment and discharge. The WPCF currently treats to a level of 4 mg/l or less of total nitrogen before the discharge of effluent. This is far better than the current nitrogen load from the area from septic systems, which is estimated using an average discharge concentration of 35 mg/l for the existing systems. In the case of the alternative where the area is connected to the Marion WPCF, the final nitrogen load is also moved from the existing area to the ultimate receiving water of the WPCF, Aucoot Cove.

Summary of Nitrogen Reduction

Conventional Septic Systems: 15,800 GPD @ 35 mg/l → 4.6 lb/day of N
Marion WOCF Treatment 15,800 GPD @ 4 mg/l → 0.5 lb/day of N

Net Reduction of Nitrogen = 4.1 pounds per day of N (>88% reduction)

The planning level construction costs related to extension of sewers to this area are summarized in Table 5-37.

Table 5-37: Upper Front Street Sewer Extension Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	-	-	None anticipated.
Low Pressure Sewer	8,500 ft	$1,700,000	-
Sewer Force Main	-	-	None anticipated.
Sewer Pump Station	-	-	None anticipated.
On-lot Grinder Pumps	99	$990,000	-
Downstream Sewer Improvements	700 ft	$140,000	Bypass existing LP sewer with new LP sewer along Front Street from Briggs Terrace to Cranberry Way.
Summary	-	$2,800,000	-

Based on the anticipation that the sewer extension to this area would serve approximately 99 unsewered parcels, the average cost per parcel to extend sewers to this area is approximately $29,000 per parcel.

Comparison of Alternatives

The comparison of feasible alternatives for the Upper Front Street area is summarized in Table 5-38.

Table 5-38: Summary of Alternatives for Upper Front Street Needs Area

Alternative	Nitrogen Impacts	Approximate Cost per Parcel	Other Considerations
No-Action	Nitrogen load remains at 4.6 lb/day	Unknown	Individual system actions would likely occur over time, as needed by individual conditions.
Enhanced On-Site Treatment	Nitrogen load reduced to 2.5 lb/day (>45% reduction)	$40,000	Requires additional septic system regulations and enforcement to achieve nitrogen reduction.
Sewer Extension	Nitrogen load reduced to 0.5 lb/day (>88% reduction)	$29,000	

5.1.3.11 County Road

The County Road area consists mainly of properties along the County Road north of Point Road and Sherman' Way north of Point Road. The suitability of alternatives for this area is summaries in Table 5-39.

Table 5-39: Alternative Screen for County Road Needs Area

Alternative	Key Factors for Screening	Selected for Further Consideration
No Action	Area is adjacent to the Sippican River which is not impaired for nitrogen. This alternative does not significantly reduce nitrogen impact.	✓
Enhanced (I/A) Septic Systems	Enhanced on-site treatment may allow for some reduction of nitrogen impacts to waterways.	✓
Localized (Cluster) Treatment	Area is close to existing sewer system, making sewer extension more feasible than localized treatment.	
Sewer Extension	Existing system is close to the needs area and will provide maximum reduction of pollutant load.	✓

Based on this preliminary screening, three feasible alternatives are considered for this needs area – no action, enhanced on-site treatment, and extension of sewers.

No Action
This alternative requires no significant action or change by the Town, and on-site systems may continue to be used. Responsibility for maintaining each septic system remains solely with the individual property owner. This includes compliance with all current regulations, including the *Septic System Denitrification Regulation* which requires that denitrification systems be installed for new systems and replacement of nonconforming failed systems at the time of transfer. This regulation will likely lead to a reduction of nitrogen from septic systems, though occurring over a long (indeterminate) time period.

Enhanced On-Site Treatment
This alternative would include developing and implementing a program to provide more advanced treatment using on-site systems in the needs area. Based on a preliminary review of the area, the average lot sizes and soil conditions appear to allow the implementation of this alternative in the area.

For the purposes of assessing nitrogen impacts, this report assumes that the area is currently served primarily by fully compliant Title 5 septic systems. Therefore, the current nitrogen load is estimated using an average discharge concentration of 35 mg/l for the existing systems. Under this alternative, a program to improve systems in the needs area over time would be implemented. At the conclusion of such a program, the assumption is that the systems in this area would meet current target levels of optimal nitrogen removal for on-site systems, producing average discharge concentration of 19 mg/l.

Summary of Nitrogen Reduction
Conventional Septic Systems: 6,400 GPD @ 35 mg/l → 1.9 lb/ day of N
Proposed Enhanced Systems: 6,400 GPD @ 19 mg/l → 1.0 lb/ day of N

Net Reduction of Nitrogen = 0.9 pounds per day of N (>45% reduction)

Cost of improvements to septic systems in the area will vary significantly, as the characteristics of individual lots are different. However, for the purposes of cost considerations, this report assumes that each on-site system in the area will eventually need to be upgraded to meet new standards, and that the average cost of these upgrades will be $40,000 or more per system. One advantage of this approach is that the improvements to individual systems can be implemented over a rolling schedule, where parcel upgrade systems on a schedule are more desirable to individual property owners.

Extension of Public Sewers

The existing sewer system lies in relatively close proximity to the County Road needs area (to the south of this area lies the Front Street low pressure sewer lines that were extended to serve the Berry areas, and to the east lies the gravity sewer system and the Point Road PS). Based on a preliminary review, an extension of public sewers to the needs area was laid out for planning and cost development purposes. If this area is selected for sewering, detailed design should be implemented to confirm the approach to extending sewers to this area.

The County Road needs area may be served by a system composed primarily of low pressure sewer lines. As depicted on f5-13 (attached), this area would include installing new sewers on Sherman's Way and portions of County Road and Point Road across I-195. The existing 1.5-inch low pressure sewer line in County Road (between Blueberry Way and Front Street) is too small to accommodate the flows from this service area, so the new low pressure sewers in County Road would extend past that area, and ultimately connect to the existing low pressure sewer main in Front Street. Based on a preliminary review, downstream capacity in the sewer lines below this area is believed to exist for the flows from this area.

For the purposes of assessing nitrogen impacts, this report assumes that the area is currently served primarily by fully compliant Title 5 septic systems. Therefore, the current nitrogen load is estimated using an average discharge concentration of 35 mg/l for the existing systems. Under this alternative, a program to improve systems in the needs area over time would be implemented. At the conclusion of such a program, the assumption is that the systems in this area would meet current target levels of optimal nitrogen removal for on-site systems, producing average discharge concentration of 19 mg/l.

Summary of Nitrogen Reduction

Conventional Septic Systems: 6,400 GPD @ 35 mg/l → 1.9 lb/day of N
Marion WOCF Treatment: 6,400 GPD @ 4 mg/l → 0.2 lb/day of N

Net Reduction of Nitrogen = 1.7 pounds per day of N (>88% reduction)

The planning level construction costs related to extension of sewers to this area are summarized in Table 5-40.

Table 5-40: County Road Area Sewer Extension Construction Cost Approximation

System Component	Approximate Quantity	Approximate Construction Cost	Notes
Gravity Sewer	-	-	None anticipated.
Low Pressure Sewer	6,100 ft	$1,200,000	-
Sewer Force Main	-	-	None anticipated.
Sewer Pump Station	-	-	None anticipated.
On-lot Grinder Pumps	53	$530,000	-
Downstream Sewer Improvements	500 ft	$100,000	Bypass existing 1.5" LP sewer along County Road with new LP sewer.
Summary	-	$1,800,000	-

Based on the anticipation that the sewer extension to this area would serve approximately 53 unsewered parcels, the average cost per parcel to extend sewers to this area is approximately $34,000 per parcel.

Comparison of Alternatives

The comparison of feasible alternatives for the County Road needs area is summarized in Table 5-41.

Table 5-41: Summary of Alternatives for County Road Needs Area

Alternative	Nitrogen Impacts	Approximate Cost per Parcel	Other Considerations
No-Action	Nitrogen load remains at 1.9 lb/day	Unknown	Individual system actions would likely occur over time, as needed by individual conditions.
Enhanced On-Site Treatment	Nitrogen load reduced to 1.0 lb/day (>45% reduction)	$40,000	Requires additional septic system regulations and enforcement to achieve nitrogen reduction.
Sewer Extension	Nitrogen load reduced to 0.2 lb/day (>88% reduction)	$34,000	

5.1.3.12 Sewer Extension Summary

A summary of all the sewer extension options presented for specific needs areas above is provided in Table 5-42. This table illustrates the variation in costs per parcel served for sewer extensions to various areas.

Table 5-42: Summary of Sewer Extension Alternatives

Needs Area	Future Parcels Connected	Estimated Existing Flow (GPD)	Nitrogen Reduction from Current (lbs/day)	Total Cost	Cost per Parcel
River Road/ Wareham Road	82	12,700	3.3	$2,300,000	$28,000
Delano Road / Weweantic River	33	5,200	1.3	$1,200,000	$36,000
Wings Cove / Piney Point	196	29,700	7.7	$9,200,000	$47,000
Lower Sippican Neck	38	5,900	1.5	$4,600,000	$120,000
Planting Island	79	12,400	3.2	$5,000,000	$63,000
Allens Point/ Harbor East	34	4,800	1.2	$2,100,000	$63,000
Converse Point	26	3,800	1.0	$1,400,000	$54,000
Aucoot Creek	44	6,800	1.8	$4,600,000	$104,000
Lower Mill Street	111	17,200	4.4	$4,700,000	$42,000
Upper Front Street	99	15,800	4.1	$2,800,000	$29,000
County Road	53	6,400	1.7	$1,800,000	$34,000
Combined (Planting Island + Lower Sippican Neck + Wings Cove/ Piney Point)	313	48,000	12.4	$13,600,000	$44,000
Combined (Aucoot Cove + Lower Mill Street)	155	24,000	6.2	$7,000,000	$45,000

The potential extension of sewers to areas identified in this section was the subject of detailed discussions at meetings of the CWMP Citizens Advisory Committee (CAC) and the Marion Select Board.

These detailed discussions reflected a local preference for sewering areas where the extension of sewers was feasible and cost-effective, as the benefits to local water quality in the Town's waters is important. These stakeholder groups recognized, however, that limited capacity will likely be available for treatment of the wastewater from these future sewer areas, and as such, the groups both concluded that extension of sewers should be prioritized to areas which have the greatest need and will result in the greatest benefit to the community. These recommendations will be summarized in the Recommended Plan section of this CWMP.

5.2 Sewer Collection System Alternatives

The discussion of alternatives related to the sewer collection system is organized into three main components:

- the existing collection system (primarily pipelines), including infiltration/inflow considerations,
- special collection system considerations, specifically related to private sewers and individual grinder pump systems, and
- sewer pumps stations and force mains.

Each of these collection system issues is summarized in the following sub-sections, with detail provided as appropriate for specific discussions.

5.2.1 *Existing Sewer Collection System*

Along with the future potential sewer extensions, the existing sewer collection system (pipeline and manholes) will continue to be operated and maintained by the Marion Department of Public Works Sewer Division. This remains true both under the local alternative for future wastewater treatment and the regional alternative.

There are various drivers for pipeline improvement- hydraulic capacity for future development/re-development, age of pipeline to prevent failure, issues (e.g., sags, root intrusion, etc.) identified in prior or future investigations, and mitigation of extraneous flows. The hydraulic capacity driver has been discussed in prior report sections, and pipeline improvements to the existing system for the increased flow from the Needs Areas has been built into the analysis for connection of those potential sewer extensions. Pipeline improvement or upgrade may also be needed for future development/re-development projects. The downstream capacity impacts from these types of projects should be considered on a case-by-case basis through the Site Plan Review application process that is in place, which has included peer review of such applications and confirmation of downstream system impacts. Other issues with existing pipelines are identified by inspections and/or investigations (such as CCTV) and, once known, are prioritized for repair or replacement.

There are not necessarily alternatives that need consideration for the overall maintenance of the existing pipelines and manholes, but rather, budget and timing alternatives for when the solutions can be implemented, which include the following:

Table 5-43: Summary of Sewer Pipeline & Manhole Maintenance Alternatives

Alternative Approaches	
A	No Change – Continue to budget and expend the same amount (plus inflation) for system operation and maintenance
B	Continue with the Plan – Increase budget and spending to account for recommendations in the continuing annual I&I removal plan and other identified priority improvements
C	Devote More Funding from Development – Town adopts a formal policy that future development/re-development projects in Town contribute to system rehabilitation to increase available funding for improvements.

As the evolution of the sewer collection system is driven by ongoing development, redevelopment and sewer connection activity, each of these alternative approaches may be employed (situationally). Based on treatment capacity needs (discussed elsewhere in this report) and past observed conditions in the sewer system, the Town needs to remain committed to the infiltration/inflow (I&I) analysis and control program for the foreseeable future. The continued focus of funds from new sources (such as development contributions) on the I&I program should be emphasized, where possible.

5.2.2 *Special Sewer System Considerations*

Based on the components of the Marion sewer system, there are two additional items that the project team focused on to develop alternatives for Town consideration - Private Sewer Systems and Individual Grinder Pump Systems.

5.2.2.1 Private Sewer Systems

As noted in prior chapters of this report, the large number of private sewer lines in Marion creates challenges with system maintenance access, responsibility, responsiveness, public/user perception, and user connection fees. Some of these challenges are alleviated if the private sewers are located on public ways or if proper easements have been secured. However, some challenges still exist regardless of pipeline location. The alternatives that have been identified to overcome the various challenges range from addressing future private sewer extensions to addressing both existing and future private sewer lines. These alternative approaches are summarized in Table 5-44.

Table 5-44: Summary of Private Sewer Alternatives

Alternative Approaches	
A	No Change – Private Sewers Remain as an Acceptable Option for New Extensions in Marion
B	Increase Regulation – Town Adopts Regulations that are More Prescriptive on How Private Sewers are Constructed and Maintained
C	Disallow Future Private Lines – Town Adopts Policy that Future Sewers in Town may not be Privately Owned, but No Change to Existing Private Sewers
D	Disallow Future & Increase Regulation for Existing – Adopt Policy on No Future Private Sewers & Adopt Regulations that are More Prescriptive on How Existing Private Sewers are Maintained
E	Disallow Future & Phase Out Private Lines – Adopt Policy on No Future Private Sewers & Begin Process of Town Taking All Private Lines

These options were discussed in significant detail with the Select Board at a workshop meeting on January 13, 2022. Option A was determined to not be feasible for the Town due to the significant challenges that exist and the need to maintain equity to system users. Option E was thought to be complex, invasive and likely too much of a change for Marion, and as such there would likely be difficulty

garnering support for this approach. The focus of the discussion was on the merits of enhancing Town Sewer regulations to better standardize requirements and provide a consistent basis for applicants in the future. Public education and discussion of this item is needed to make homeowners aware of private sewer locations before changes will be acceptable to the public for existing lines that fall into this category. Therefore, based on the discussion, the preferred alternative may be a hybrid between a few of the private sewer alternatives.

The consensus was that policy changes are needed so that all sewers (public and private) are built to the same standards and with proper oversight and accessibility for maintenance/repair. The revised policy should also not allow private new sewer lines to be built in public ways. More planning will be required to determine the best approach for what is to be done with existing private sewers that have been built in public ways, but the goal would be for the Town to acquire ownership of those lines, if they are not a significant liability. For private sewers that are proposed on private roads, the revised policy should make this distinction and require a contact entity for the private sewer (an association or individual), an easement access agreement (in case of an emergency). Refinement of the policies will be needed based on continued discussion and future action by the Select Board.

5.2.2.2 Individual Grinder Pump Systems

Similar to the private sewer item discussed above, Marion also deals with challenges related to ownership and maintenance of individual grinder pumps on the segments of the existing system that are served by low-pressure sewer (versus gravity sewer segments). This issue relates to the individual grinder pump units installed as part of Town sewer projects. Any recently installed grinder pump units or those proposed for future installation do not contribute to these challenges, as those units are owned and maintained by individual property-owners. The challenges discussed here are related to the grinder pump units that were installed previously, but continue to be maintained by the Town. The growing costs of these maintenance activities as the pump units age increase the need for attention to the issues. Alternative approaches for grinder pump maintenance are summarized in Table 5-45.

Table 5-45: Summary of Grinder Pump Alternatives

Alternative Approaches	
A	No Change – Town Continues to Maintain GPs
B	Maintain with Fee – Town Continues to Maintain GPs, but Adds a Fee for Units Maintained
C	Stop Maintaining (Immediate) – Town Immediately Ceases Maintenance & Directs Responsibility to Property Owners
D	Stop Maintaining (Phased) – Town Ceases Maintenance on a Rolling Basis & Directs Responsibility to Property Owners
E	Stop Maintaining (Future Date) – Town Elects a Future Date to Transition Maintenance to Property Owners
F	Comprehensive Maintenance – Town Maintains all GPs withing the System, with a Fee System

These options were also discussed in significant detail with the Select Board at a workshop meeting. While significant benefits were discussed for a number of alternatives, a reasonable amount of support was exhibited by the board for the alternative B concept. A significant amount of public concern was expressed by local residents whose grinder pumps are currently maintained by the Town as to cost impacts from changes to this policy. The Select Board will need to continue the discussion of these

alternatives at a future working meeting, and eventually propose changes, with provisions for public input, before a final grinder pump maintenance policy is set.

5.2.3 *Sewer Pump Stations and Force Mains*

For each of the pump stations, a general range of alternatives is available that could possibly be suited to meeting the facility needs. Each of these alternatives are generally described as follows.

No Action – No significant action is required at the pump station. Existing needs and concerns may be addressed by ongoing operation and maintenance (O&M) activities, and minor repair. These activities and any minor capital needs are expected to be included in the normal annual operation budget.

Minor Renovation/Repair – Significant action is required at the pump station, but can be addressed with limited scope repairs or minor renovations to the facility. Most major components of the facility have significant remaining service life. Improvements may be done at one time or completed in multiple phases over time.

Major Renovation/Repair – Significant action is required at the pump station, including major renovation or upgrades efforts. Some major components of the facility have significant remaining service life. A major renovation or upgrade project is needed to address deficiencies.

Complete Replacement – The pump station requires significant action and the existing facility is not suited for continued service. Replacement of the pump station and abandonment of the existing facility is needed.

Elimination & Abandonment – The pump station will no longer be needed at some point, due to the ability to reconfigure the collection system. The existing facility may be abandoned after rerouting of flows to gravity sewers or other pumping systems.

The applicability of these alternatives to each pump station in Marion's system is summarized in Table 5-46.

Table 5-46: Pump Station Alternative Screening

Pump Station	No Action	Minor Renovation	Major Renovation	Complete Replacement	Eliminate/ Abandon
Front Street PS			✓	✓	
Silvershell PS			✓	✓	
Creek Rd PS [1]			✓	✓	
Oakdale PS			✓	✓	
Parkway PS		✓	✓		[2]
Point Rd PS	✓	✓			
Littleneck PS	✓	✓			
Stoney Run PS	✓	✓			

[1] A replacement of the Creek Road PS has been designed and is awaiting construction.
[2] Replacement with low pressure sewers is possible, but does not appear cost effective.

A brief discussion of each pump station follows. It should be noted that the force mains for each pump station also require consideration, and are discussed where notable.

5.2.3.1 Front Street PS

The existing Front Street PS has undergone minor renovations, including most recently some resiliency improvements (new bypass connections funded by a CZM grant). Long-term, the changes in flood elevations will drive the need for major renovations or replacement of the station. Short-term repairs may help defer the more significant changes for later implementation. A new (initially redundant) force main for this station is discussed with the WPCF improvements.

5.2.3.2 Silvershell PS

The Silvershell PS was renovated to incorporate submersible pumps. However, due to its location and resiliency concerns, the PS will need major renovations or full replacement to address long-term needs. A replacement of the Silvershell PS force main is anticipated to be needed based on age and material of construction.

5.2.3.3 Creek Road PS

The Creek Road PS is in critical need of attention. Under a CZM resiliency grant, the design of a replacement for this PS has been designed. The Town is pursuing funds to construct the replacement project. If the replacement is not completed, major renovations could be an option (though not recommended due to conditions at the PS). An assessment of the Creek Road PS force main is needed.

5.2.3.4 Oakdale PS

The Oakdale PS is in need of significant improvements and is also located such that resiliency is a major concern. Major renovations or full replacement will be needed for this PS.

5.2.3.5 Littleneck PS

The Littleneck PS has a number of deficiencies which should be corrected by repairs or improved. Minor renovations may be the most appropriate solution at this PS.

5.2.3.6 Parkway PS

The Parkway PS has a number of deficiencies that require attention. Options for eliminating the PS and replacing with low pressure sewers have been considered. However, repair and renovation options are feasible at this PS.

5.2.3.7 Point Road PS

The Point Road PS was also renovated to include submersible pumps. The age and condition of the PS suggest that further minor or major renovation is appropriate for this station.

5.2.3.8 Stoney Run PS

The Stoney Run PS has a number of deficiencies which should be corrected by repair or renovation. Minor renovations may be the most appropriate solution at this PS.

5.3 WPCF Treatment and Discharge Alternatives

The discussion of alternatives related to the treatment and discharge of wastewater at the Marion WPCF is organized into four components, including identification and screening of alternatives, general

discussion of individual alternatives, evaluation of specific alternatives, and alternative considerations related to specific process and facility needs at the WPCF. A summary of the alternatives is presented at the end of the section.

5.3.1 *Identification and Screening of Treatment and Discharge Alternatives*

The needs related to the treatment wastewater and discharge of treated effluent are separated for discussion into two basic categories. First, there are broad issues that need to be addressed – the 'big picture' needs. These include the larger issues related to treatment and discharge capacity, specific permit compliance issues such as nutrients (nitrogen and phosphorus) and copper, and the facility approach to the management and disposal of biosolids. The second category are 'specific' needs. These are needs related to the condition and state of facilities and systems, and include issues related to modernization, physical condition, technology and sustainability needs. Many of these latter needs are related to identified deficiencies in the WPCF and its systems. The primary WPCF alternatives discussion focuses on the 'big picture' needs, and considerations related to the specific facility needs are discussed at the end of the section.

The CWMP process has included review of a wide range of conditions and planning considerations that are critical to developing a plan of action for the Marion WPCF. The broad needs of the community for wastewater treatment include five 'big picture' needs:

- Treatment and Discharge Capacity
- Nitrogen Treatment and Permit Compliance
- Phosphorus Treatment and Permit Compliance
- Copper Treatment and Permit Compliance
- Waste Biosolids (Sludge) Management and Disposal

For each of these community needs, a range of alternatives have been identified and considered and discussed. These discussions are summarized as follows.

5.3.1.1 Treatment and Discharge Capacity

As discussed in the preceding sections of the CWMP, the treatment and discharge capacity for the Marion WPCF is limited by the existing treatment processes and the NPDES discharge permit for the facility. The most significant limiting factor is currently the NPDES permit, which restricts the discharge of the facility to 588,000 gpd (on a 12-month rolling average basis). With the exception of a brief exceedance of this NPDES capacity at the end of 2019, the WPCF has consistently operated within the NPDES capacity limit and at the current time, appears to have a small amount of available unused capacity. Beyond the discharge permit limits, the WPCF is limited by the functional operation of the sequencing batch reactor (SBR) process, and the facility's ability to meet the strict discharge permit limits during periods of higher flows. These processes effectively limit the treatment capacity of the facility to a maximum daily flow. While the theoretical design of the WPCF targeted a maximum daily capacity of approximately 1.20 MGD, the actual functional capacity of the facility is currently estimated at a maximum daily capacity of approximately 1.05 MGD.

Based on the flow projections prepared in Section 3 of this CWMP, and the proposed need for future extension of sewers to some of the currently unsewered needs areas, the projected capacity needs for the Marion WPCF are summarized in Table 5-47.

Table 5-47: Future Average Daily Design Flow for WPCF

Flow Description	Average (MGD)
Existing Flows	0.515
Infill & Growth in Sewered Areas	0.050
Unsewered System Needs Areas (Recommended)	0.091
Planned/Anticipated Development	0.030
Proposed Future Average Daily Flow to WPCF - TOTAL	**0.686**

The future capacity needs of the WPCF exceed the current treatment and discharge capacity. Therefore, alternatives have been identified to address the need for further treatment capacity at the facility, should these flows be realized in the future. Alternatives identified in the screening as relevant to this capacity need are summarized in Table 5-48.

Table 5-48: Summary of Treatment Capacity Alternatives

General Need	General Alternatives for Screening
Treatment Capacity How much wastewater the WPCF can treat and discharge. Current NPDES permit limits WPCF discharge to 0.588 MGD.	Water Conservation
	Infiltration/Inflow Removal
	WPCF Process Rerating
	WPCF Process Improvements
	Permit Modification
	Effluent Reuse
	Groundwater Discharge
	Outfall Relocation
	Regionalization

Each of the general alternatives identified for screening are discussed in Section 5.3.2, and suitable alternatives are included in the evaluation that follows in Section 5.3.3.

5.3.1.2 Nitrogen Treatment and Permit Compliance

The ability of the WPCF to treat and discharge nutrients (nitrogen and phosphorus) is a significant factor in considering alternatives. The WPCF currently has a stringent NPDES discharge permit limit on Total Nitrogen (TN), a limit for Ammonia Nitrogen (NH_3-N), and monitoring requirements for other nitrogen parameters. The limits include the notable seasonal (April through October) TN limits of 4.0 mg/l and 19.6 pound per day (based on a six-month rolling average). These discharge limits for nitrogen are among the lowest nitrogen limits in the state. While the WPCF has generally met these limits in the past, achieving these low levels of effluent nitrogen is challenging.

Based on the planning work completed to date, future additional flows to the WPCF will include an increase in the influent loading for nitrogen. As such, the WPCF will need to continue to meet these low limits despite higher influent loadings. Therefore, alternatives have been identified to address the need

for continuing to meet nitrogen effluent limits. Alternatives identified in the screening as relevant to this nitrogen treatment need are summarized in Table 5-49.

Table 5-49: Summary of Nitrogen Treatment Alternatives

General Need	General Alternatives for Screening
Nitrogen Treatment The WPCF is designed to treat nitrogen within discharge limits. Current NPDES permit limits nitrogen discharge to 4.0 mg/l and 19.6 lbs/d (seasonally).	WPCF Process Improvements
	Permit Modification
	Effluent Reuse
	Groundwater Discharge
	Outfall Relocation
	Regionalization
	Non-Point Source Mitigation

Each of the general alternatives identified for screening are discussed in Section 5.3.2, and suitable alternatives are included in the evaluation that follows in Section 5.3.3.

5.3.1.3 Phosphorus Treatment and Permit Compliance

The WPCF currently has a NPDES discharge permit that includes limits on Total Phosphorus in the effluent. However, past regulatory agreements have stayed this limit, and as such the facility has not instituted treatment for phosphorus. The written permit includes seasonal (April through October) phosphorus limits of 200 ug/l (micrograms per liter) and 0.98 pound per day (as well as monitoring requirements for phosphorus in other months). The WPCF will need to make future provisions for treatment of phosphorus, unless the Town of Marion opts for a regional treatment option as allowed for in the regulatory actions.

Based on the planning work completed to date, the continued use of the WPCF will require attention to address phosphorus. Therefore, alternatives have been identified to address the need for meeting effluent phosphorus limits. Alternatives identified in the screening as relevant to this phosphorus treatment need are summarized in Table 5-50.

Table 5-50: Summary of Phosphorus Treatment Alternatives

General Need	General Alternatives for Screening
Phosphorus Treatment The WPCF is not presently designed to treat phosphorus within proposed discharge limits. Current NPDES permit limits [1] phosphorus discharge to 200 ug/l and 0.98 lbs/d (seasonally).	WPCF Process Improvements
	Permit Modification
	Effluent Reuse
	Groundwater Discharge
	Outfall Relocation
	Regionalization
	Non-Point Source Mitigation

Notes: [1] This is the written permit limit, which is currently stayed by regulatory action.

Each of the general alternatives identified for screening are discussed in Section 5.3.2, and suitable alternatives are included in the evaluation that follows in Section 5.3.3.

5.3.1.4 Copper Treatment and Permit Compliance

The WPCF currently has a NPDES discharge permit that includes limits on Total Copper in the effluent. However, past regulatory agreements have provided for a higher interim limit, and the facility has been taking actions to comply with the interim limit. The written permit includes effluent copper limits of 7.7 ug/l, average monthly, and 11.3 ug/l, maximum daily. These low copper limits are extremely challenging for any treatment facility to meet. The interim regulatory limit in place currently requires treatment to 20 ug/l of total copper. The WPCF has met the interim limits in the past, with some exceedances, and continues to take actions to limit copper in its effluent. The facility will need to make provisions for treatment of copper to meet the long-term limits, unless the Town of Marion opts for a regional treatment option as allowed for in the regulatory actions.

Based on the planning work completed to date, the continued use of the WPCF will require attention to address copper. Therefore, alternatives have been identified to address the need for meeting effluent copper limits. Alternatives identified in the screening as relevant to this copper treatment need are summarized in Table 5-51.

Table 5-51: Summary of Copper Treatment Alternatives

General Need	General Alternatives for Screening
Copper Treatment The WPCF is not presently designed to treat copper within proposed discharge limits. Current NPDES permit limits [1] copper discharge to 7.7 ug/l average monthly.	WPCF Process Improvements
	Permit Modification
	Groundwater Discharge
	Outfall Relocation
	Regionalization
	Source Control

Notes: [1] This is the written permit limit. Regulatory action currently provides an interim limit of 20 ug/l.

Each of the general alternatives identified for screening are discussed in Section 5.3.2, and suitable alternatives are included in the evaluation that follows in Section 5.3.3.

5.3.1.5 Biosolids (Sludge) Management and Disposal

The WPCF has historically managed biosolids (sludge) by disposal on site in the wastewater lagoons. As a result of regulatory enforcement action, Marion recently implemented a lagoon improvement project, which included the lining of lagoon No. 1, among other improvements. As part of that work, over 1,000 dry tons of waste sludge was removed from the lagoon, dewatered and hauled off site for disposal. That disposal effort resulted in significant cost to the Town. Based on the planning effort to date, a defined long-term plan for solids management and disposal is recommended. Therefore, alternatives have been identified to address solids management. Alternatives identified in the screening as relevant to this solids management need are summarized in Table 5-52.

Table 5-52: Summary of Biosolids Management Alternatives

General Need	General Alternatives for Screening
Biosolids (Sludge) Management The WPCF has historically disposed of sludge to on-site lagoons.	WPCF Process Improvements
	Regionalization
	Continued Disposal to Lagoon
	Thicken Solids & Haul Away
	Dewater Solids & Haul Away

Each of the general alternatives identified for screening are discussed in Section 5.3.2, and suitable alternatives are included in the evaluation that follows in Section 5.3.3.

5.3.2 *Description of Specific Treatment and Discharge Alternatives*

The general alternatives identified for screening as relevant to the 'big picture' needs are each described briefly herein. These descriptions include alternatives which may be less effective (which are not carried forward) and alternatives which may be more effective (in which case, those are discussed further in the following evaluation section of this report).

5.3.2.1 No Action

This alternative would include proceeding with treatment and discharge as has been done historically, with no significant actions to address wastewater management in Town. Based on the needs identified in this CWMP and the existing regulatory requirements placed on the Marion system, the No Action alternative is not a reasonable option for the Town.

5.3.2.2 Water Conservation

One alternative component to create some capacity in the existing sewer system and, in the longer term, maintain capacity is for current users to decrease the amount of water used. Many communities in Massachusetts have implemented aggressive water conservation programs that have been successful in reducing water consumption by 5% to 20%. Marion currently employs outdoor watering restrictions during summer months, though this only indirectly addresses potential sewer capacity impacts. Additional conservation efforts such as a public education campaign about water conservation and/or subsidies for low-flow fixtures could serve to help keep wastewater flows minimized and to conserve drinking water resources. However, the impact of such efforts is unlikely to have a dramatic effect on total sewer flow, recognizing that some households are likely already using water-efficient devices, while others may not replace high-water-use fixtures until they are required to do so. While the magnitude of capacity required to meet existing and future wastewater needs cannot simply be accommodated by water conservation practices alone, they are an important component for sustainability of other capacity creation efforts.

5.3.2.3 Infiltration/Inflow Removal

As with all wastewater systems, the need for infrastructure repair and modernization increases with age. In Marion, the collection system is subject to extraneous flows from infiltration and inflow (I&I), as discussed in prior sections of this report. These extraneous flows not only use limited capacity in the collection system (pipelines and pump stations), but I&I flows also tax the capacity of the WPCF for both

treatment and discharge. The Town has been performing I&I investigation and control measures for many years, and this work has seen increased emphasis over the past two decades.

Most recently, Marion has implemented a comprehensive Annual Program to investigate I&I and remediate the extraneous flows. This new Annual Program began in 2019, and has scheduled annual inspections and repairs of the Town's collection system through 2029. Maintaining these regular efforts to reduce the impacts of I&I on the system capacity is another component that is integral to preserving (and restoring) treatment capacity at the WPCF to meet the Town's current and future wastewater treatment demands.

5.3.2.4 Process Re-rating of WPCF

Many wastewater treatment facilities are constructed in ways that provide for treatment of additional capacity beyond the limits documented in the original design. In these cases, a desktop process (that is termed a "rerating" of the facility) may be used to provide for operational changes to the treatment of additional flows and/or loads without the need for physical modifications of the facility. In the case of the Marion WPCF, the operational limits of the facility are well established, and while the facility offers significant potential for further capacity with limited improvements, the possibility of rerating the WPCF alone is not a reasonable option.

5.3.2.5 Process Improvements at WPCF

Process improvements at the WPCF play a significant role in a wide range of alternatives considered in this CWMP. Taken alone, physical improvements at the WPCF can be implemented to address such areas as treatment capacity, nutrients and metals treatment, and the processing of biosolids. To provide complete solutions to facility needs, these improvements will need to be coupled with other solutions – notably, changes to the discharge permit for the WPCF. Specific process improvements needed are identified in the detailed alternatives discussions presented later.

5.3.2.6 Surface Water Discharge Permit Modification

The Marion WPCF is limited to discharging flows within its current NPDES discharge permit, with an average daily flow limit of 0.588 MGD. In the present day, increases to NPDES permitted discharge capacity for Massachusetts communities are rare (and have been significantly contentious when proposed). The federal NPDES program generally allows for increases up to 10% of the permitted capacity for the system to be considered 'deminimus' – essentially having limited impact on the receiving water. These increases are subject to meeting anti-degradation provisions. In addition, the Massachusetts Environmental Policy Act (MEPA) program allows for changes to surface water discharges from wastewater treatment facilities of up to 100,000 gpd without the need to submit a significant additional environmental assessment under MEPA. Therefore, for planning purposes, Marion could move forward with a future WPCF treatment capacity that would include a 'deminimus' capacity increase. The nominal future design capacity for the WPCF identified in this CWMP would meet these provisions. Also as stated earlier, ongoing I&I remediation efforts should also continue to help protect available WPCF capacity in the interim. Addressing EPA and DEP requirements for the new permit increase (including anti-degradation provisions) would be a key requirement for the Town.

5.3.2.7 Effluent Reuse

Historically, treated effluent is discharged either to a surface water body, as is the current case in Marion, or to the ground with percolation through the soil to the groundwater. Another option is to reuse the treated wastewater for non-potable needs. The State of Massachusetts and some communities have

adopted policies on wastewater reuse in an effort to conserve valuable water resources and provide a means for the disposal of treated effluent. One common approach to beneficial reuse is to recharge aquifers through groundwater discharge – this practice is considered indirect reuse as is further described below.

Direct reuse of highly treated effluent is also permissible in certain areas and is seeing more common application. Typical methods of reuse include outside watering applications in landscaping and agriculture and inside recycling for use as toilet water. Commercial and industrial facilities in Massachusetts have demonstrated the effectiveness of these systems. A properly developed wastewater reclamation program can provide valuable benefits to both Marion and its users. With proper treatment, reclaimed wastewater poses minimal health risks, while providing the community with a conservative solution to their wastewater disposal problem.

Unfortunately, in New England due to seasonal weather constraints, systems that rely primarily on landscape watering for effluent reuse must often be supplemented with a permanent disposal option (such as surface or groundwater disposal) for use in winter months. In warmer months, possible effluent reuse options at sports fields or golf courses may be viable. The Town may choose to evaluate this option further, and would need to consider the cost of effluent transportation via a reuse water pipeline. While distant from the WPCF, the Marion Golf Club and Kittansett Club golf courses on Sippican Neck could be considered for effluent reuse. These options may be more feasible if a decentralized treatment option (with a new small treatment facility) is proven as a reasonable option in this area in the future.

Effluent reuse options tend to present themselves for landscape watering for industrial and institutional facilities. Some small commercial/industrial areas lie in close proximity to the Marion WPCF, and these may be worthy of further consideration in the future. In these cases, controls on the water quality and public exposure can be better managed. Lacking large disposal areas, reuse does not appear to offer a complete solution to capacity challenges for the WPCF. However, based on the high effluent quality currently being required in the Marion WPCF discharge permit, the Town should keep the option of possible effluent reuse open for future discussion, particularly for planned new and redevelopment in Marion that may be nearby to the WPCF.

5.3.2.8 Groundwater Discharge

Groundwater disposal of treated wastewater is the most commonly applied solution in rural areas, where individual septic systems treat waste before discharging to the ground via infiltration systems. These discharges are covered under the Massachusetts Title 5 program for individual systems, and have proven effective. For much of the Town of Marion, these systems continue to be a preferred wastewater management method for individual parcels, where off-site options are not required based on needs defined throughout this report.

The requirements for groundwater discharge of wastewater (above what is covered by Massachusetts Title 5) are outlined in the state laws pertaining to the Groundwater Discharge Permit program (314 CMR 5.00 and 6.00). This GWDP program generally covers discharges of 10,000 gpd or more to the ground. The principal constituents of concern for groundwater discharges are pathogens and nitrogen. Traditionally, the need to remove nitrogen has been a disadvantage for groundwater discharge options, but recent changes requiring low levels of effluent nitrogen and phosphorus in surface discharges make groundwater disposal a more reasonable alternative. In Marion's case, the WPCF already meets very low nitrogen and pathogen standards in its effluent.

Groundwater disposal is becoming more common in Massachusetts for collected wastewater from communities and significant developments. The groundwater disposal option involves the discharge of highly treated effluent from a wastewater treatment facility into an infiltration bed or subsurface distribution system. For purposes of this discussion, the location of the discharge may be considered independent of the location of the treatment facility, since the treated effluent can be transmitted by pressure main to the infiltration system. However, given the large amount of open space surrounding the Marion WPCF, a discharge site nearby the WPCF may be available. Also, based on anticipated operational changes at the Marion WPCF regarding the use of existing lagoons, it is possible that some portion of the lagoon areas (e.g., part of Lagoon 3) could be repurposed for groundwater discharge in the future. Unfortunately, based on the known historic fact that water in the unlined lagoons does not readily infiltrate into the ground through the lagoon bottoms, the WPCF area may not be suitable for groundwater discharge.

Potential sites for use as a groundwater disposal site must be comprised of sandy or gravely soils that exhibit moderate infiltration rates. Sites that contain poor soil permeability, high groundwater levels, and/or ledge inhibit the downward flow of water and are generally unacceptable. Shallow surface soil properties can be improved by excavating and amending the soils in the discharge area or mounding the infiltration beds. Soils with slight or moderate limitations for wastewater disposal are considered acceptable for effluent beds with proper design considerations.

In general, some groundwater discharge may be an option for Marion for the future additional capacity needed at the WPCF and assuming an increase in the NPDES surface water discharge permit cannot be obtained. This option also remains viable for individual properties and smaller developments in Town, as well as for decentralized/satellite treatment systems that may be considered in the future for needs areas that are more remote from the existing sewer system.

5.3.2.9 Outfall Relocation

The outfall for the WPCF currently discharges at the 'Effluent Brook', which is tributary to Aucoot Cove. Extending the discharge pipe to alternate locations has been previously proposed and evaluated to move the discharge to a larger receiving water. Relocating the outfall provides the possible opportunity to avoid some of the process upgrades at the WPCF (as described elsewhere in this CWMP). By moving the discharge location to a new receiving water, it is possible that some NPDES limits could be relaxed from current requirements.

Extending the existing outfall pipe to discharge at the head of the saltmarsh that borders Aucoot Cove would allow the potential of eliminating Total Phosphorus permit limits because the effluent would then bypass the fresh waters of Effluent Brook. Extending the existing outfall pipe further, into outer Aucoot Cove, presents the opportunity to potentially eliminate Total Phosphorus and mitigate Total Nitrogen permit limits, and to possibly reduce or eliminate the copper limits (because then the effluent would discharge to the deep waters in Aucoot Cove, providing improved mixing and dilution). The main disadvantages to extending the outfall pipe is that implementation would have a significant cost and require extensive permitting - and there are no guarantees for less stringent discharge permit requirements. Discussion with the regulatory groups would be required to determine the true feasibility of this option.

5.3.2.10 Source Control of Pollutants

Source control of pollutants needs to be considered to prevent or reduce pollutants from entering a

system. For municipally owned properties, operational controls include instituting measures for spill prevention and cleanup, good housekeeping practices, preventative maintenance procedures, and development of pollution prevention teams. In addition to pollutants, reduction of products that may contribute excess nutrients to the sewer system would also fall under this operational source control category. Requirements and/or educational materials for similar programs for residential and commercial owners in Marion could increase source control of pollutants/excess nutrients from entering the sewer system and requiring treatment at and disposal from the WPCF. Operational controls are generally considered one of the most cost-effective pollutant minimization practices.

Copper is one of the contaminants of concern at the Marion WPCF, both currently and for future anticipated discharge permit requirements. Copper in wastewater comes significantly from corrosion of pipes in the potable drinking water systems. While there are processes for treating to remove copper that could be added to the WPCF, the preferred method involves source control. Copper source control would include managing the pH of Marion's drinking water system and using chemical additives prior to distribution. These techniques can reduce the corrosion of copper pipes in local homes and businesses, thereby reducing the copper loading from such corrosion from entering the sewer system and reaching the WPCF (from properties connected to the sewer). Marion has implemented a corrosion control program in their water systems, and continues to implement measures to control copper. Based on findings in the *2021 Copper Optimization Report* by Tata & Howard, the water departments have increased the pH of the water supply and effectively contributed to reductions of copper in the WPCF influent. This approach offers promise for Marion to meet current copper limits at the WPCF.

5.3.2.11 Non-Point Source Mitigation of Pollutants

Urban runoff and other non-point sources of pollutants are a leading source of water quality impairments in surface waters, like those that make up much of Marion. In addition to stormwater-related non-point sources, inadequately functioning septic systems are another source of pollutants and excess nutrients reaching groundwater and surface water, and thus contributing to degradation of water quality. Marion has implemented the *Septic System Denitrification Regulation* as an additional measure towards reducing excess nitrogen into the environment. However, elimination of septic systems is a more final alternative for non-point source control. Sewer extensions to the needs areas identified in this report will achieve the goal of mitigating pollutant contribution from areas of Town that are either environmentally sensitive resource areas or areas that have difficulty supporting functional septic systems.

Additionally, the Town can implement public education and regulatory mechanisms encouraging residents and local industry to reduce the disposal of pollutants to the sewer. Municipally-run residential waste drop off programs and public education provide low cost opportunities to decrease the potential nutrient and pollutant loading (from improper disposal of pollutants) to the WPCF. Local regulations and restrictions pertaining to the use of fertilizers target nitrogen and phosphorus, which if used excessively or run-off to a water body, can also contribute to water quality concerns. Good non-point source management is always appropriate but does not specifically offer a full scale solution to Marion's wastewater management needs.

5.3.2.12 Biosolids (Sludge) Management

The Marion WPCF has historically disposed of biosolids in its on-site lagoon system. Over the past several decades (until 2020), no records are available to suggest historic attempts to remove and dispose of significant biosolids from the lagoons. As part of the lagoon improvements project initiated in 2020, the work of removing, dewatering and disposing of the accumulated solids in Lagoon No. 1

was undertaken. This project continued into 2021 and was completed to allow installation of the new liner in Lagoon No. 1. The final volume of biosolids removed and disposed of as part of this process is difficult to estimate precisely because significant amounts of underlying soils (gravels/sand/till) were found mixed with the solids scraped from the lagoon bottom. However, we estimate that over 1,300 dry tons of sludge have been removed under the project. These solids were dewatered on site and trucked away for disposal out of state.

Going forward, three alternatives were identified for the management of biosolids at the WPCF:

- Continued Use of Lagoons for Biosolids Disposal
- Thicken and Haul Away Biosolids
- Dewater and Haul Away Biosolids

As the assessment of these alternatives are relatively independent of the other 'big picture' needs for the WPCF. The evaluation of these alternatives is discussed separately in the following section.

5.3.2.13 Regionalization

As discussed earlier in this report, a regional option to centralize treatment for surrounding communities (including Marion) at the Wareham WPCF continues to be in the planning stages. Marion has been continuing to participate in the preliminary regionalization planning process concurrent with the timeline of this CWMP process. In early 2022, a summary of the *The Upper Bay Regional Wastewater Feasibility Assessment* was issued to Marion for review by the Buzzards Bay Coalition, and can be found in Appendix G. The summary document provided some key findings of the regional study, but a full report was not available. Based on the information provided to Marion and reviewed, comparison to the local alternatives for wastewater treatment was completed for this CWMP (as presented in the detailed discussion of alternatives). It is important to note that the regional alternative will also require certain components of the local plan, including existing sewer system (pipeline and pump station) improvements, sewer extensions to the needs areas and policy considerations for system considerations (for items such as grinder pumps and private sewer). Additionally, the timing for implementation of a regional alternative is likely to be rather long-term, which will require the Marion WPCF to continue operations during the interim period, if the regional alternative is found to be preferred.

5.3.3 *Evaluation of Treatment and Discharge Alternatives*

Based on the screening and discussion of alternatives, the most feasible alternatives (in most cases, combinations of alternatives) are presented here in more detail. These alternatives were selected to provide significant options for addressing the 'big picture' needs for the WPCF. Alternatives to address biosolids management are by nature able to be separated from the other alternative discussions, and as such are discussed separately at the end of this section.

Cost Considerations

The discussion of alternatives includes anticipated costs related to feasible alternatives. The cost information presented is based on general experiences in the implementation of similar systems. In some cases, previous detailed studies prepared costs for some alternatives that are relevant (e.g., outfall extensions), and we have referenced those costs (escalated, as appropriate). Planning level costs are, by nature, not precise because the details of constructing any type of system are major factors in determining costs, and such details are yet to be established during the planning process. These planning level costs are intended to cover general construction and construction related costs. In all cases, the cost basis is presented for comparison of alternatives, and more precise costs (if desired) would only be available for systems for which design details are developed more fully. For comparison

purposes, we have generally carried costs forward in tables to show no more than two significant digits; though this does not suggest a degree of 'precision' for these costs. Further discussion of costs for recommended improvements will be provided in Section 6 of this CWMP.

5.3.3.1 Alternative A – Process Improvements & Permit Modifications (Process Improvements)

The 'big picture' needs of the WPCF can be met by a combination of process improvements and modification of the NPDES discharge permit. Several other defined alternatives would play roles in meeting the permit needs under this alternative, including source control to limit copper discharges, and non-point source mitigation to support nitrogen reduction in the receiving waters. For the purposes of this discussion, there are two levels of this alternative presented, defined further as follows.

Alternative A1 – Process Improvements & Optimization

This alternative would include an approach to improving the WPCF which is focused on limiting capital costs as best possible while meeting the needs and permit conditions. The primary focus of this approach is to optimize use of the existing WPCF infrastructure to treat additional flows. This would include modifying the operation of the SBR system to treat more flow without building additional SBR tankage. Improvements needed to implement this alternative would generally include:

- Modification of the existing SBR decanting systems, process control and equalization tanks to allow the treatment of additional flows.
- Improvements for chemical precipitation system to meet phosphorus limit.
- Source control to address copper limit.

The likely effectiveness of this alternative to meet the WPCF 'big picture' needs is summarized in Table 5-53.

Table 5-53: Alternative A1 – Process Improvements & Optimization Effectiveness

WPCF Need	Effectiveness of Alternative at Addressing Need
Capacity	Good. Provides additional capacity needed. Requires NPDES permit increase in effluent discharge limit.
Nitrogen	Good. Will continue to require a high level of nitrogen reduction. Nitrogen load to the surface/ground water will be mitigated by non-point source removal and treatment at the WPCF prior to discharge.
Phosphorus	Good. Phosphorus removal would be provided.
Copper	Limited. Copper removal would be addressed by source control.
Bio-Solids Management	Not applicable. For this alternative, separate biosolids management is needed.

The planning level capital cost for developing and implementing this alternative is summarized in Table 5-54. The costs presented include anticipated costs for engineering design and construction of the required process improvements.

Table 5-54: Alternative A1 – Process Improvements & Optimization Capital Cost Summary

Description of Improvement	Capital Cost
Modification of the existing SBR decanting systems, process control and equalization tanks	$1,500,000
Improvements for chemical precipitation system to meet phosphorus limit	$1,000,000
Source control to address copper limit	N/A
Total Capital Cost	$2,500,000

Alternative A1 has a high likelihood of being successfully implemented. The most challenging aspect of this alternative is the need for a NPDES permit modification allowing an increase in the limit on treated effluent.

Alternative A2 – Process Improvements & 3rd SBR

This alternative would include an approach to improving the WPCF which will provide a robust and resilient treatment system to meet the needs and permit conditions. The primary focus of this approach is to expand the existing WPCF infrastructure to include the addition of a third SBR tank to treat additional flows. Improvements needed to implement this alternative would generally include:

- Construction of a new, third SBR tank with ancillary work, and modifying the process controls to allow the treatment of additional flows.
- Improvements for chemical precipitation system to meet phosphorus limit.
- Source control to address copper limit.

The likely effectiveness of this alternative to meet the WPCF 'big picture' needs is summarized in Table 5-55.

Table 5-55: Alternative A2 – Process Improvements & 3rd SBR Effectiveness

WPCF Need	Effectiveness of Alternative at Addressing Need
Capacity	Good. Provides additional capacity needed. Requires NPDES permit increase in effluent discharge limit.
Nitrogen	Good. Will continue to require a high level of nitrogen reduction. Nitrogen load to be mitigated by non-point source removal.
Phosphorus	Good. Phosphorus removal would be provided.
Copper	Limited. Copper removal would be addressed by source control.
Bio-Solids Management	Not applicable. For this alternative, separate biosolids management is needed.

The planning level capital cost for developing and implementing this alternative is summarized in Table 5-56. The costs presented include anticipated costs for engineering design and construction of the required process improvements.

Table 5-56: Alternative A2 – Process Improvements & Optimization Capital Cost Summary

Description of Improvement	Capital Cost
Construction of a new, third SBR tank with ancillary work	$3,500,000
Improvements for chemical precipitation system to meet phosphorus limit	$1,000,000
Source control to address copper limit	N/A
Total Capital Cost	$4,500,000

Alternative A2 has a high likelihood of being successfully implemented. The most challenging aspect of this alternative is the need for a NPDES permit modification allowing an increase in the limit on treated effluent. While more costly than alternative A1, the addition of the third SBR adds an additional degree of resiliency to the process, and will reduce the reliance on the lagoons by being able to treat significantly higher flows.

5.3.3.2 Alternative B – Groundwater Discharge, Process Improvements, & Permit Modification (Groundwater Discharge)

The WPCF needs can also be met by a combination of process improvements and the addition of groundwater discharge (GWD) for some or all of the treated effluent. This alternative would require a new Massachusetts DEP permit for the groundwater discharge, and possibly modifications to the NPDES permit. This option depends upon the physical ability of the soils at the WPCF and/or adjacent site areas to accept long-term effluent flows, and as such would require a detailed hydrogeological analysis to be completed if the alternative is selected for further consideration. It is notable that the likely ability of the site to accept a smaller amount of effluent is significantly better than its ability to accept all of the plant effluent. For this reason, there are two levels of this alternative presented, defined further as follows.

Alternative B1 – Groundwater Discharge & Supplemental Discharge

This alternative would include developing a groundwater discharge system at the WPCF and keeping the surface water discharge and the associated NPDES permit. The groundwater discharge would be used to discharge flows in excess of the NPDES permitted flows (588,000 gpd average daily flow) but could also be used to discharge flows continuously (and thereby more effectively reduce the quantity of effluent discharged to Aucoot Cove, and the associated calculated loadings). Improvements needed to implement this alternative would generally include:

- Construction of a new, third SBR tank with ancillary work, and modifying the process controls to allow the treatment of additional flows.
- New GWD effluent diversion piping, dosing tank and pumping system.
- New groundwater discharge to open sand beds (rapid infiltration beds).
- A new groundwater discharge permit issued by Massachusetts DEP.
- Improvements for chemical precipitation system to meet phosphorus limit.
- Source control to address copper limit.

The likely effectiveness of this alternative to meet the WPCF 'big picture' needs is summarized in Table 5-57.

Table 5-57: Alternative B1 – Groundwater Discharge / Supplemental Discharge Effectiveness

WPCF Need	Effectiveness of Alternative at Addressing Need
Capacity	Excellent. Provides additional capacity needed.
Nitrogen	Limited. Both surface water and groundwater discharges will require nitrogen reduction. Helps reduce total nitrogen load to Aucoot Cove.
Phosphorus	Limited. Phosphorus removal would still be required for surface water discharge flows but would not be required for discharges to the ground. Helps reduce phosphorus load to receiving water (brook).
Copper	Limited. Copper removal would still be required for surface water discharge flows but would not be required for discharges to the ground.
Bio-Solids Management	Not applicable. For this alternative, separate biosolids management is needed.

The planning level capital cost for developing and implementing this alternative is summarized in Table 5-58. The costs presented include anticipated costs for engineering and hydrogeological studies, GWD permitting, design and construction of new GWD system components, and other required process improvements.

Table 5-58: Alternative B1 – Groundwater Discharge / Supplemental Discharge Cost Summary

Description of Improvement	Capital Cost
Hydrogeological and engineering to support GWDP	$300,000
New GWD effluent diversion piping, dosing tank and pumping system	$1,000,000
New groundwater discharge to open sand beds (rapid infiltration beds)	$1,500,000
Construction of a new, third SBR tank with ancillary work	$3,500,000
Improvements for chemical precipitation system to meet phosphorus limit	$1,000,000
Source control to address copper limit	N/A
Total Capital Cost	$7,300,000

Alternative B1 has a good likelihood of being successfully implemented. The most challenging aspect of this alternative is the ability to find a discharge area with soil conditions suitable for the GWD. While this alternative has a limited effect on meeting the nutrient discharge limits, the inclusion of improvements intended to meet those limits within the cost of this alternative allows this alternative to be viewed as equal to Alternatives A1 and A2 in its effectiveness at meeting the WPCF needs.

Alternative B2 – Groundwater Discharge/All Flows

This alternative would include developing a groundwater discharge system at the WPCF for the discharge of all treated effluent. Under this alternative, the current surface water discharge and the associated NPDES permit would no longer be needed and could potentially be sunset (or possibly maintained for use in discharging treated effluent during high flow events). The groundwater discharge would be used to discharge all permitted flows, and effectively eliminates daily effluent discharge to Aucoot Cove. Improvements needed to implement this alternative would generally include the same components identified for Alternative B1, though with a larger discharge system capacity. However, the phosphorus treatment and copper source control actions would no longer be needed.

The likely effectiveness of this alternative to meet the WPCF 'big picture' needs is summarized in Table 5-59.

Table 5-59: Alternative B2 – Groundwater Discharge / All Flows Effectiveness

WPCF Need	Effectiveness of Alternative at Addressing Need
Capacity	Excellent. Provides for existing and additional capacity needed.
Nitrogen	Limited. Groundwater discharge will continue to require nitrogen reduction. Helps reduce total nitrogen load to Aucoot Cove.
Phosphorus	Excellent. No phosphorus treatment would be required for discharges to the ground. Helps reduce phosphorus load to receiving water (brook).
Copper	Excellent. Copper removal would not be required for discharges to the ground.
Bio-Solids Management	Not applicable. For this alternative, separate biosolids management is needed.

The planning level capital cost for developing and implementing this alternative is summarized in Table 5-60. The costs presented include anticipated costs for engineering and hydrogeological studies, GWD permitting, and design and construction of new GWD system components.

Table 5-60: Alternative B2 – Groundwater Discharge / All Flows Cost Summary

Description of Improvement	Capital Cost
Hydrogeological and engineering to support GWDP	$500,000
New GWD effluent diversion piping, dosing tank and pumping system	$1,200,000
New groundwater discharge to open sand beds (rapid infiltration beds)	$4,000,000
Construction of a new, third SBR tank with ancillary work	$3,500,000
Improvements for chemical precipitation system to meet phosphorus limit	N/A
Source control to address copper limit	N/A
Total Capital Cost	$9,200,000

Alternative B2 has a low likelihood of being successfully implemented. The most challenging aspect of this alternative is the ability to find a large discharge area with soil conditions suitable for the GWD.

5.3.3.3 Alternative C – Outfall Relocation, Process Improvements & Permit Modification (Outfall Relocation)

The WPCF needs can also be met by a combination of process improvements and the relocation of the WPCF outfall, in addition to related NPDES permit modifications. Several other defined alternatives would play roles in meeting the permit needs under this alternative, including source control to limit copper discharges, and non-point source mitigation to support nitrogen reduction in the receiving waters. Options for extending the Marion WPCF outfall were explored in detail in a study by CDM Smith, and the study findings were summarized in a March 2016 memorandum. For the purposes of this discussion, we have included two levels of this alternative defined further as follows.

Alternative C1 – Outfall Relocation to Salt Marsh

This alternative would include extending the existing outfall to the saltmarsh area at the end of the Effluent Brook. This option is essentially Alternative 1 (1A/1B) from the 2016 study. The primary benefit of this outfall extension would be to eliminate the freshwater (brook) receiving water from the NPDES permit considerations – thus eliminating the need to treat to remove phosphorus. This alternative is not expected to change the need for nitrogen treatment. This alternative would also not eliminate the need for action to address copper in the effluent (based on the last draft NPDES permit, this change could trigger a lower copper limit in the next draft NPDES permit). Improvements needed to implement this alternative would generally include:

- Construction of a new, third SBR tank with ancillary work, and modifying the process controls to allow the treatment of additional flows (as included with Alternative A2).
- New extended outfall (approximately 5,200 feet of additional outfall).
- Source control to address copper limit.

The likely effectiveness of this alternative to meet the WPCF 'big picture' needs is summarized in Table 5-61.

Table 5-61: Alternative C1 – Outfall Extension to Salt Marsh Effectiveness

WPCF Need	Effectiveness of Alternative at Addressing Need
Capacity	Good. Provides additional capacity needed. Requires NPDES permit increase in effluent discharge limit.
Nitrogen	Good. Will continue to require a high level of nitrogen reduction. Nitrogen load to be mitigated by non-point source removal.
Phosphorus	Excellent. No phosphorus treatment would be required for discharges to the salt marsh. Helps reduce phosphorus load to receiving water (Effluent Brook).
Copper	Limited. Copper removal would be addressed by source control.
Bio-Solids Management	Not applicable. For this alternative, separate biosolids management is needed.

The planning level capital cost for developing and implementing this alternative is summarized in Table 5-62. The costs presented include anticipated costs for engineering design and construction of the new outfall extension and other required process improvements.

Table 5-62: Alternative C1 – Outfall Extension to Salt Marsh Cost Summary

Description of Improvement	Capital Cost
Extension of Outfall to Salt Marsh (end of Effluent Brook) [1]	$3,800,000
Construction of a new, third SBR tank with ancillary work	$3,500,000
Improvements for chemical precipitation system to meet phosphorus limit	N/A
Source control to address copper limit	N/A
Total Capital Cost	$7,300,000

[1] This cost is escalated from the cost of Alterative 1B provided in the 2016 CDM Smith memorandum, using an escalation of 1.287 to account for 6 years of cost escalation.

Alternative C1 has a good likelihood of being successfully implemented. The most challenging aspects of this alternative are the permitting and access provisions to complete the outfall extension, and the significant risk of unforeseen costs related to construction.

Alternative C2 – Outfall Relocation to Outer Aucoot Cove

This alternative would include extending the existing outfall to the saltmarsh area at the end of the Effluent Brook. This option is essentially Alternative 3 from the 2016 study (all options 2, 3, 4 and 5 have a similar intent, but used different outfall routes). The primary benefit of this outfall extension would be to eliminate the freshwater (brook) receiving water from the NPDES permit considerations – thus eliminating the need to treat to remove phosphorus. This intent of the longer outfall extension is to reduce the need for nitrogen treatment at the facility, though this result is not a certainty. This alternative may also not eliminate the need for action to address copper in the effluent (based on the last draft NPDES permit, this change could trigger a lower copper limit in the next draft NPDES permit). The impacts on both the nitrogen and copper permit limits would be subject of a mixing zone analysis which would be needed as part of the outfall extension. For the purposes of comparison, this alternative assumes that the mixing zone approach would be moderately successful. Improvements needed to implement this alternative would generally include:

- Construction of a new, third SBR tank with ancillary work, and modifying the process controls to allow the treatment of additional flows (as included with Alternative A2).
- New extended outfall (approximately 17,800 feet of additional outfall).
- Source control to address copper limit.

The likely effectiveness of this alternative to meet the WPCF 'big picture' needs is summarized in Table 5-63.

Table 5-63: Alternative C2 – Outfall Extension to Outer Aucoot Cove Effectiveness

WPCF Need	Effectiveness of Alternative at Addressing Need
Capacity	Good. Provides additional capacity needed. Requires NPDES permit increase in effluent discharge limit.
Nitrogen	Good. Will continue to require a high level of nitrogen reduction. Nitrogen load to be mitigated by non-point source removal.
Phosphorus	Excellent. No phosphorus treatment would be required for discharges to the salt marsh. Helps reduce phosphorus load to receiving water (Effluent Brook).
Copper	Good. Copper removal would be addressed by source control, though mixing zone analysis would be completed with the goal of a higher copper limit.
Bio-Solids Management	Not applicable.

The planning level capital cost for developing and implementing this alternative is summarized in Table 5-64. The costs presented include anticipated costs for engineering design and construction of the new outfall extension and other required process improvements.

Table 5-64: Alternative C2 – Outfall Extension to Outer Aucoot Cove Cost Summary

Description of Improvement	Capital Cost
Extension of Outfall to Outer Aucoot Cove [1]	$44,400,000
Construction of a new, third SBR tank with ancillary work	$3,500,000
Improvements for chemical precipitation system to meet phosphorus limit	N/A
Source control to address copper limit	N/A
Total Capital Cost	$47,900,000

[1] This cost is escalated from the cost of Alterative 3A provided in the 2016 CDM Smith memorandum, using an escalation of 1.287 to account for 6 years of cost escalation.

Due to the complexity of this option, Alternative C2 has a low likelihood of being successfully implemented. The most challenging aspects of this alternative are the extensive permitting and access provisions to complete the outfall extension, and the significant risk of unforeseen costs related to construction, particularly related to unknown subsurface conditions along the outfall route.

5.3.3.4 Alternative D – Regionalization with Wareham

The 'big picture' needs of the WPCF can be met by a regionalization approach which would send all flows to the Wareham system for treatment and disposal. For the purposes of comparison, this alternative assumes that Marion's flows would be transmitted and stored at the Marion WPCF site to mitigate peak flow rates. All flows would then be pumped to the Wareham sewer system for eventual treatment at the Wareham WPCF. The assumption is that effluent flows would ultimately be discharged to the Cape Cod Canal via a new extended outfall (as proposed by recent studies by Wareham and the Coalition for Buzzards Bay). Under this alternative, Marion's current surface water discharge and the associated NPDES permit would no longer be needed and could potentially be sunset (or possibly maintained for emergency use in discharging during high flow events).

The effect of this alternative would be to discontinue treatment activity at the Marion WPCF, which would allow decommissioning of significant portions of the WPCF. The regional Wareham WPCF would require a new NPDES permit for treatment and discharge of effluent, including treating for nitrogen, phosphorus and copper as required by such a future permit. Improvements needed to implement this alternative would generally include:

- Modifications and decommissioning activities for some process areas at the existing Marion WPCF.
- New wastewater transmission systems to pump flows to the Wareham sewer system.
- Improvements to the Wareham WPCF to allow the treatment of flows from Marion and other regional wastewater flows.
- New outfall and associated discharge permit for the combined discharge of regional flows.

The likely effectiveness of this alternative to meet the WPCF 'big picture' needs is summarized in Table 5-65.

Table 5-65: Alternative D – Regionalization with Wareham Effectiveness

WPCF Need	Effectiveness of Alternative at Addressing Need
Capacity	Good. All treatment capacity would be the responsibility of the regional entity.
Nitrogen	Good. All nitrogen treatment would be the responsibility of the regional entity.
Phosphorus	Good. All phosphorus treatment would be the responsibility of the regional entity.
Copper	Good. All copper treatment would be the responsibility of the regional entity.
Bio-Solids Management	Good. All biosolids management would be the responsibility of the regional entity.

The planning level capital cost for developing and implementing this alternative is summarized in Table 5-66. The costs presented include anticipated costs for engineering design and construction of the new regional sewer connection, treatment and outfall, and selective decommissioning improvements at the Marion WPCF.

Table 5-66: Alternative D – Regionalization to Wareham Cost Summary

Description of Improvement	Capital Cost
New Transmission System to Wareham Sewer System [1]	$34,000,000
Improvements/Reconstruction of Wareham WPCF [2]	$24,000,000
New Regional Outfall to Cape Cod Canal [3]	$12,000,000
Modifications and decommissioning at Marion WPCF	$1,000,000
Total Capital Cost	$71,000,000

[1] This cost is escalated from the 2018 memorandum by GHD, using a multiplier factor of 1.152 to account for 4 years of cost escalation.
[2] This cost is taken from the Upper Bay Regional Wastewater Feasibility Assessment issued February 2022, calculated Marion's share of improvements to the Wareham's WPCF as 24% of $100,000,000 total cost, and 24% of $48,500,000 total New Regional Outfall cost.

Alternative D has a moderate (or lower) likelihood of being successfully implemented. Beyond the high costs, there are many challenging aspects of this alternative, including the extensive regulatory, permitting and inter-governmental coordination needed, the known and unknown obstacles to the outfall extension, the lack of detailed planning available for the Wareham system, and the significant risk of unforeseen costs related to construction, particularly related to unknown subsurface conditions long the long pipeline routes.

5.3.3.5 Biosolids Management Alternatives

The screening discussion identified three levels of biosolids management for consideration, in addition to the overall regional treatment alternative. The overall regional alternative would include the treatment of all wastewater at a new/upgraded Wareham WPCF, and that regional treatment would include solids management at and disposal from the regional facility. The remaining three alternatives would include varied degrees of process improvements at the Marion WPCF to support the selected biosolids management approach. The capital costs for these alternatives are summarized in Table 5-67.

Table 5-67: Biosolids Management Alternatives Cost Summary

Description of Improvement	Capital Cost
Continued Use of Lagoons for Biosolids Management & Disposal [1]	TBD
WPCF Improvements to Thicken and Dispose of Biosolids Off-Site [2]	$2,000,000
WPCF Improvements to Dewater and Dispose of Biosolids Off-Site [3]	$14,000,000

[1] Recognizing recent lagoon improvements project, no capital cost is carried for this alternative. However, future capital investments may be required depending on the requirements of regulatory action related to the lagoons.
[2] This cost includes the construction of a new gravity thickener structure at the WPCF, which would be used in concert with the improved lagoon system to manage biosolids.
[3] This cost includes the construction of a new solids thickening and dewatering system, including a new building to house the dewatering system at the WPCF.

For these biosolids management alternatives, the capital costs are often justified by the annual cost savings related to the trucking and disposal of biosolids. Marion does not currently have a line item for annual biosolids disposal in its WPCF operating budget, as no typical hauling of sludge is done. Therefore, annual costs are not expected to justify the high capital costs for implementing dewatering at the WPCF. Also, based on the size of the Marion WPCF, and the known staffing limitations that have existed, the dewatering alternative is not considered feasible at this time.

The option to thicken solids on site using a gravity thickener requires a significant, but not cost-prohibitive investment. As such, the further discussion of this alternative is carried forward for comparison into later discussions. The assumption is that solids will eventually need to be hauled off site for disposal – even if stored in the lagoons for a long period of time. The thickening option should then remain in discussion as an alternative to just using lagoons for storage and disposing of solids directly from the lagoons periodically.

5.3.4 *Alternative Considerations for Other WPCF Process Needs*

As part of the review of the broader alternatives (as discussed above), the cost of actions to address specific needs at the facility should be considered. These 'specific' needs are related to the condition and state of facilities and systems, and include issues related to modernization, physical condition, technology and sustainability needs. Many of these latter needs are related to identified deficiencies in the WPCF and its systems. In the case of some broader alternatives, many of these specific needs will continue to require attention. In some alternative cases, these needs are mitigated or become less important (e.g., process needs which will not be continued under the regional alternative).

Table 5-68 provides a summary of these needs which should be included in most alternatives. Budget level costs to address these specific needs are also included in the summary table.

Table 5-68: WPCF Auxiliary Needs and Cost Summary

Treatment Area	Treatment Need	Auxiliary Capital Cost	Relevant Treatment Alternative			
			A	B	C	D
Influent Pumping	Front Street PS force main redundancy	$2,000,000	x	x	x	x
Headworks	Miscellaneous headworks repairs	$250,000	x	x	x	x
	Media replacement for biofilter	$50,000	x	x	x	x
	Upgrade of soda ash system	$100,000	x	x	x	x[1]
SBR	Concrete repair for SBR tanks	$500,000	x	x	x	x[1]
	Scum improvements	$200,000[2]	x	x	x	
	Replacement of submersible mixer rails	$60,000	x	x	x	x[1]
	Addition of water hydrants near SBR basins	$50,000	x	x	x	
	Replacement of SBR mounted DO probes and display systems	$30,000	x	x	x	x[1]
Instrumentation & Control	Review of general control systems	$35,000	x	x	x	x[1]
	Radio telemetry system communicating with the sewer pump stations	$100,000	x	x	x	x
	General upgrade to instrumentation and I&C/SCADA systems	$300,000	x	x	x	
Main Operations Building	Vehicle and trailer storage	$1,500,000	x	x	x	x
	Floor repair garage (ceiling in blower room)	$100,000	x	x	x	x
Disk Filter Building	Replace pumps at Side Stream PS	$100,000	x	x	x	x[1]
	Concrete evaluation for wet well at Side Stream PS	TBD[3]	x	x	x	x[1]
	Safe access equipment in two filter bays	$100,000	x	x	x	x[1]
UV Disinfection	Architectural improvements to the building including roof and skylight replacement and other sealing work around the building envelope	$125,000	x	x	x	
Lagoon System	Assess sludge and lagoon support systems in Lagoon No.2 (and Lagoon No.3 as appropriate), and complete improvements	TBD[3]	x	x	x	x
Flow Metering	Replace effluent flow meter system (relocate downstream of effluent filters)	$150,000	x	x[4]	x	
Buildings & Site	Installation of vactor truck dump station	$200,000	x	x	x	x
	SCADA Fiber optics between buildings	$500,000	x	x	x	

[1] Due to the time required to implement Alternative D – Regionalization, these treatments needs will be required to serve the facility in the near future.
[2] Preliminary design will be required to determine the nature of scum improvements. The cost provided is a budget figure.
[3] "TBD" costs require additional scoping and as such no capital cost estimations are provided in this table.
[4] These treatment needs are not required for Alternative B2 but may be required for B1.

For all alternatives, with the exception of D – Regionalization with Wareham, additional costs for bio-solids handling and disposal will need to be considered. Currently, the WPCF utilizes its lagoons for this purpose. However, with the lining of Lagoon 1 and future considerations for the operation of all lagoons, additional bio-solids handling should be included for alternatives in which the Marion WPCF continues to receive and treat wastewater. For the purposes of this analysis, $2,000,000 is carried for the cost of bio-solids handling and disposal, but a robust analysis should be performed prior to final design of improvements to confirm scope and costs.

Table 5-69: WPCF Alternatives with Auxiliary Needs Cost Summary

Alternative	Alternative Cost	Bio-Solids Cost	Auxiliary Cost	Total Capital Cost
A1 – Process Improvements - Optimization	$2,500,000	$2,000,000	$6,300,000	$10,800,000
A2 – Process Improvements - 3rd SBR	$4,500,000	$2,000,000	$6,300,000	$12,800,000
B1 – Groundwater Discharge - Supplemental Discharge	$7,300,000	$2,000,000	$6,300,000	$15,600,000
B2 – Groundwater Discharge - All Flows	$9,200,000	$2,000,000	$6,100,000	$17,300,000
C1 – Outfall Relocation to Salt Marsh	$7,300,000	$2,000,000	$6,300,000	$15,600,000
C2 – Outfall Relocation to Outer Aucoot Cove	$47,900,000	$2,000,000	$6,300,000	$56,200,000
D – Regionalization with Wareham	$71,000,000	$0	$4,900,000	$75,900,000

5.3.5 *Summary of WPCF Alternatives*

Overall consideration of the available alternatives for Marion should be based on both cost and non-cost factors. The degree to which each of the WPCF alternatives meets the Town needs, the total capital cost and the overall feasibility (likelihood of being implemented) of these alternatives is summarized in Table 5-70.

Table 5-70: WPCF Alternatives Feasibility Summary

Alternative	WPCF Needs Met	Total Capital Cost	Feasibility
A1 – Process Improvements - Optimization	Good	$10,800,000	High Feasibility
A2 – Process Improvements - 3rd SBR	Good	$12,800,000	High Feasibility
B1 – Groundwater Discharge - Supplemental Discharge	Good	$15,600,000	Moderate Feasibility
B2 – Groundwater Discharge - All Flows	Excellent	$17,300,000	Low Feasibility
C1 – Outfall Relocation to Salt Marsh	Good	$15,600,000	Moderate Feasibility
C2 – Outfall Relocation to Outer Aucoot Cove	Good	$56,200,000	Low Feasibility
D – Regionalization with Wareham	Good	$75,900,000	Moderate to Low Feasibility

Additional consideration of the most effective, feasible and affordable alternatives is appropriate. Additional financial considerations may include the effect on annual system costs (e.g., operation and maintenance), and these costs are best considered in combination with the capital costs through a calculation of present worth. For this continued comparison, we have eliminated the less feasible alternatives B2 and C2 from the discussion. While the feasibility of the regional alternative (D) is questionable, we have carried that alternative forward here for further discussion.

A calculation of present worth for the five 'feasible' options is presented in Table 5-71. The annual costs presented in this table and used in the present worth calculation are estimates based on variation from the current annual costs carried in the Marion sewer system, as the variance from current costs best illustrates the cost impact of the alternative. These calculations use a 20-year present worth, assuming an annual return rate of 5% (nominal).

Table 5-71: WPCF Alternatives Present Worth

Alternative	Capital Cost	Annual Cost Impact	20 year Present Worth
A1 – Process Improvements - Optimization	$10,800,000	$220,000 [1]	$13.5M
A2 – Process Improvements - 3rd SBR	$12,800,000	$220,000 [1]	$15.5M
B1 – Groundwater Discharge - Supplemental Discharge	$15,600,000	$260,000 [2]	$18.8M
C1 – Outfall Relocation to Salt Marsh	$15,600,000	$140,000 [3]	$17.3M
D – Regionalization with Wareham	$79,500,000	$1,480,000 [4]	$98.0M

[1] Alternatives A1 and A2 both include a $40,000 increase in electricity use attributed to additional flows and process uses, an $80,000 increase for additional chemical treatment costs, and a nominal $100,000 increase for hauling and disposal of biosolids.
[2] Alternative B1 includes the costs noted for Alternatives A1/A2, plus a $40,000 cost for annual sampling, testing and permit coordination related to the new groundwater discharge.
[3] Alternative C1 include a $40,000 increase in electricity use attributed to additional flows and process uses and a nominal $100,000 increase for hauling and disposal of biosolids.
[4] Alternative D includes an anticipated savings of $180,000 on line items in the current Marion WPCF budget that will no longer be required due to regional treatment, plus an additional cost of $1,660,000 paid to Wareham for regional treatment and disposal.

Of course, the solutions to Marion's local wastewater needs extend beyond the WPCF and treatment needs. As such, any discussion of the total cost for wastewater solutions must include costs related to sewer collection system, pump stations and other management recommendations. These are all summarized in the recommended plan section of this CWMP.

5.3.6 *Resiliency and Sustainability*

Many factors were considered in reviewing the alternatives and in supporting local discussions through the CWMP process. Notably amongst these are the general concepts of sustainability, and a significant part of that sustainability is resiliency. Some of the observations in these areas are summarized in the following short discussions for the major WPCF alternatives.

Alternative A - WPCF Process Improvements

The Marion WPCF is located in a relatively remote area of Town and sits at an elevation that is less subject to coastal storm impacts and lies well outside the coastal flood zones. While more energy intensive than the original lagoon treatment process, the advanced treatment process at the WPCF is relatively cost effective and has proven reliable over time. The concept of improvements to the WPCF is feasible and based on a sound understanding of facility conditions. As such, risks related to these options are generally limited – notably cost of improvements and uncertain future permit conditions are among the primary risks. Overall, these Marion WPCF options offer a consistently good resiliency and

sustainability profile.

Alternative B – Groundwater Discharge
The possibility of discharging effluent to the ground at the Marion WPCF can be considered similar the Alternative A options in its risk profile. To the degree that a limited groundwater discharge option (B1) may prove feasible, such improvements would offer a good resiliency and sustainability profile.

Alternative C – Outfall Extension
Possible extension of the WPCF outfall has a number of aspects that may be contradictory in regard to sustainability and resiliency. The possibility that an extended outfall could offer relief from permit conditions (e.g., phosphorus limits) would allow the addition of less chemical, the creation of less sludge, and the use of less energy – these would be positive from a sustainability view. However, the possible need for effluent pumping through the longer outfall would consume more energy. The location of all of the new outfall extension improvements at low elevations or below sea level also suggests more resiliency concerns than other options. As costs for these options are higher and more permitting is required, these also present elevated risks. Based on these considerations, the resiliency and sustainability profile for these options would be fair to good.

Alternative D – Regionalization
When considering sustainability and resiliency, the regional concept suggests some concerns. Notably, the plan would require Marion's wastewater flows would be transmitted a distance of over seven and a half miles from the Marion WPCF site to the Wareham WWTF site. The route of this pipeline would be through low lying coastal areas and over rivers/inlets, exposing the pipeline to significant resiliency concerns. Treatment at the Wareham is also more low lying and more susceptible to coastal storm and flooding impacts. From an energy standpoint, the long transmission line will require significant pumping energy, increasing local energy costs. The very high costs currently suggested for this alternative also suggest some larger cost risk. Overall, the sustainability and resiliency profile for this alternative appears to be fair to poor in comparison to other alternatives.

.

6.0 RECOMMENDED PLAN

6.1 Plan Selection

The CWMP Recommended Plan is a compilation of the recommendations that follow from the analyses performed and information presented in the prior planning discussions. To a great degree, the Recommended Plan follows closely from the work of the Alternatives Identification, Screening and Analysis. For the Marion CWMP, the process of developing the Recommended Plan has included review of the existing conditions and anticipated future conditions as they relate to wastewater management, review of the 'needs' information compiled from these observations, and review and discussion of feasible alternatives to address these system 'needs'.

The process of review and consideration has included a series of stakeholder discussions – many including a significant degree of detail. These discussions included various groups and functional venues, such as:

- Marion's DPW and Wastewater Division staff,
- Local representatives of a Technical Committee (comprised of key Town staff and a Select Board member),
- A Citizen's Advisory Committee (CAC) formed by the Town specifically for the purpose of reviewing CWMP issues and alternatives,
- The Marion Select Board (at their public meetings and workshops),
- CWMP Meetings with the Public.

Comments and information from each successive discussion has led to the incremental selection of key plan components. Ultimately, the Recommended Plan is a compilation of actions selected to represent functional solutions to the key local wastewater management challenges, and stakeholders intend that this plan will serve the best interests of the Town of Marion over the planning period. The discussions to date inform the Recommended Plan presented herein, but these recommendations are subject to continued public and stakeholder input.

6.2 Recommended Plan – General

The Recommended Plan presented herein has a number of components, many of which inter-relate, but a few of which are independent of other actions. The components presented in the following sections include policy and programmatic recommendations, wastewater management for un-sewered areas, collection system and pump stations improvements, and improvements to local wastewater treatment (focused generally on the Marion WPCF).

6.2.1 *Associated Costs of Recommended Plan*

The cost information presented within this section are based on general experiences in the implementation of similar systems. Planning level costs are, by nature, not precise because the details of constructing any type of system are major factors in determining costs, and such details are yet to be established during the planning process. These planning level costs are intended to cover general construction and construction related costs and should be reviewed more thoroughly once design details have been developed.

In particular, the costs of implementing environmental projects in general (and specifically in Massachusetts) have become subject to considerable inflation and other market impacts over the past two years. As such, costs for the recommendations carried herein are based on good planning factors,

and seek to be comparable to each other, but in no event are viewed as conservative for budgeting purposes. As individual projects, improvements or initiatives are to be undertaken, additional budget review should be conducted with an eye to current industry cost factors. This process should also include providing for additional contingency in the budget for each recommendation.

6.3 Management and Programmatic Recommendations

Over the course of planning, several observations have been made on overall management approaches and programs employed by the Town of Marion, or ones that should be considered. Several general and programmatic recommendations are presented herein.

6.3.1 *Individual Grinder Pump O&M Policy Change*

The Town of Marion policy of maintaining the sewage grinder pumps for many homes connected to the sewer system has been identified as a concern. The responsibility to maintain these pumps, which are part of the private sewer connections, and located on private property, comes with significant liability, both short-term and potentially long-term. A part of this concern is the question of what happens when the pumps reach the end of their service life – which is a significant concern considering the age of most of the pump units for which the Town has responsibility. The fact that the Town is responsible to maintain some, but not all of the pumps connected to the system, also creates confusion among the residents using these systems. This disparity in turn complicates the work of the Town staff to care for the overall system. As such, the following short-term and long-term recommendations to the Town's policy are provided below.

Short-term O&M Policy Recommendations

The short-term recommendations are related to the maintenance of the grinder pump units. The initial service agreements for individual grinder pumps, which were put in place shortly after installation of the Town-maintained grinder pumps, are recommended to be reviewed (and renewed, if appropriate). The Town is recommended to evaluate the plan and policy for grinder pump servicing going forward and continue to make provisions to maintain the units within the Town's current responsibility.

Long-term O&M Policy Recommendations

Long-term recommendations include reviewing the policy and engaging local discussions. Based on the history of events and on the past Town Meeting vote regarding the policy, it may take significant public outreach efforts to achieve a general policy change with regard to the Town's obligations to maintain the grinder pump units. A revised policy for use going forward is recommended to be developed. The grinder pump policy needs to address:

- Ownership of the grinder pump units,
- Responsibility for maintenance of the units,
- Access provisions for maintenance and limits of responsibility,
- Obligations for equipment/system replacement,
- Sunsetting of responsibility and transition of maintenance, as appropriate,
- Administrative, regulatory, and budget provisions related to the grinder pumps.

This long-term policy plan also needs to be considered when evaluating options for new sewer extensions that may include new low pressure sewer systems with individual grinder pumps. Furthermore, the debt service on the SRF loan that included the purchase and installation of the grinder pumps will not be retired until 2034, so any consideration to adjust the Town's level of maintenance responsibility for the grinder pumps will need to consider legal obligations related to the loan debt.

6.3.2 *On-Site Treatment Policy Change*

As discussed in Section 5 of this CWMP, the Town recently adopted enhanced regulations through their *Septic System Denitrification Regulation* for the purpose of limiting nitrogen discharges from new and expanded flows from septic systems. This regulation seeks to reduce the amount of nitrogen being discharged into the environment and provide a better level of treatment than convention on-site technologies (such as Title 5 criteria). Denitrification systems are required for all new on-site septic systems, at the time of transfer (if non-conforming) and for failed systems. Existing on-site septic systems may continue in use, but enhancements to these existing systems are recommended to assist in reducing pollutant loads. The recent enhanced regulations in new septic systems are examples of this approach, though further regulations or management programs are recommended for existing on-site septic systems.

Massachusetts DEP has recently issued for public comment draft changes to governing regulations that are intended to protect water quality in designated Nitrogen Sensitive Areas (NSA). If adopted as proposed, these regulations would require action to incorporate nitrogen removal technologies in existing septic systems that are tributary to certain nitrogen impacted waters. These proposed regulation changes go further than the recent Marion regulations, and as such, should be tracked closely by the Town.

6.3.3 *Private Sewer System Policy Change*

The large number of private sewer lines in Marion create challenges with system maintenance access, responsibility, responsiveness, public/user perception, and user connection fees. Some of these challenges are mitigated if the private sewers are located on public ways or if proper easements have been secured, however, some still exist regardless of pipeline location. To ensure that all sewers are built to include the same criteria, policy changes are recommended for all sewers (public and private) so that systems are built with the same standards, proper oversight, and accessibility for maintenance and repair. The revised policy should also consider not allowing private new sewer lines to be built in public ways. More planning will be required to determine the best approach for existing private sewers that have been built in public ways. One option is for the Town to acquire ownership of those lines; if they are not deemed a liability. For private sewers that are proposed on private roads, the revised policy should make this distinction and require a contact entity for the private sewer (an association or individual), an easement access agreement (in case of an emergency), and ensure provisions for long-term maintenance and repair.

6.3.4 *Developer Built Pump Station Policy*

When new pump stations are to be built by developers or private parties, or when existing privately built pump stations are to be accepted by the Town, it is critical that the Town require these stations to meet the same criteria as would be used for a pump station constructed by the Town. The Town should develop a clear policy to prevent the construction and acceptance of pump stations not fully meeting Town standards. This policy is recommended to include criteria related to operator attention, design and construction details, record (as-built) drawings, and operation and maintenance manuals.

6.3.5 *Local Sewer Policy & Regulations*

Local Rules and Regulations are recommended to be re-reviewed to ensure consistency with the recommendations made within this CWMP. This includes recommended policy changes for all sewers (private and public) to be built to the same standards and with proper oversight and accessibility for

maintenance and repair. Additionally, the Town should periodically review sewer user charges and related wastewater fees to ensure that these are consistent with the costs of providing service.

6.3.6 *Staffing Recommendations*

Staffing of wastewater treatment facilities with licensed operators is an industry wide challenge. This is true specifically for Marion consistent with many other small treatment facilities. Due to the limited number of operators employed at the WPCF, staffing challenges can be exacerbated by normal employee turnover events. The Town will need to maintain consistent focus on staffing to ensure that adequate operations of the WPCF is possible. The Town should periodically review the operations needs and compare the operations staffing plan with the recommendations of the New England Interstate Water Pollution Control Commission (NEIWPCC) for staffing of similar facilities.

6.4 Recommended Wastewater Management and Sewer System Extensions

The Recommended Plan for the proposed needs areas is based upon the Needs Analysis completed in Section 5.1.3. For each of the eleven (11) Needs Areas, enhanced on-site treatment systems or extension of centralized sewers has been recommended based upon review of total construction costs and nitrogen mitigation/overall water quality protection. As discussed in Section 5, the planning level costs cover general construction and other related costs. The discharge of nitrogen from wastewater is a significant concern affecting local waters and was heavily considered in selecting a recommendation for each Needs Area. As depicted in Figure 6-1 (attached), each Needs Area is shown with their recommendation of either including enhanced on-site treatment systems or being served by extensions of the centralized sewer system.

6.4.1 *Needs Areas Recommended for Enhanced On-site Treatment Systems*

As discussed in Section 5.1.1, on-site wastewater systems include individual septic systems that treat and dispose of wastewater on the same parcel on which the wastewater is generated. Conventional septic systems are governed in Massachusetts by Title 5 (State Environmental Code). These septic systems are not designed to achieve a high level of treatment of biochemical oxygen demand (BOD), total nitrogen removal, or phosphorus removal. The Town of Marion recently adopted enhanced regulations governing the design and use of septic system that go beyond the minimum standard of Title 5 design criteria. The Town's enhanced on-site septic system design uses technologies which will reduce the total amount of nitrogen being discharged into the environment, providing a better level of treatment than conventional on-site technologies. With the screening and evaluation of alternatives for wastewater management discussed in Section 5, the following unsewered Needs Areas presented in Table 6-1, and as depicted in Figure 6-2 (attached), are recommended for enhanced on-site treatment.

Table 6-1: Recommended Needs Areas for Enhanced On-Site Treatment

Needs Area	Future Parcels	Estimated Existing Flow (GPD)	Nitrogen Reduction from Current (lbs/day) [1]
Delano Road / Weweantic River	33	5,200	0.7
Allens Point/ Harbor East	34	4,800	0.9
Converse Point	26	3,800	0.5
Upper Front Street	99	15,800	2.1
County Road	53	6,400	1.0

[1] This nitrogen reduction assumes all existing systems are replaced with new systems meeting 19 mg/l total nitrogen.

Total cost per needs area and total cost per parcel for the recommended enhanced on-site treatment needs areas are provided in Table 6-2. The depicted costs are based on an average anticipated cost of approximately $40,000 per parcel to upgrade, replace or install a new septic system meeting the nitrogen reduction standards.

Table 6-2: Recommended Needs Areas for Enhanced On-Site Treatment Cost Summary

Needs Area	Future Parcels	Total Cost for Area
Delano Road / Weweantic River	33	$1,320,000
Allens Point/ Harbor East	34	$1,360,000
Converse Point	26	$1,040,000
Upper Front Street	99	$3,960,000
County Road	53	$2,120,000

The costs reflected in the table above are provided for informational and comparative consideration only. As these costs are proposed to be borne by individual homeowners and implemented on a parcel-by-parcel schedule, these aggregate costs for each area are not carried forward into later Recommended Plan summary tables.

Implementation of public education and outreach, and the effects of regulatory mechanisms will encourage property owners to implement the new technologies for septic systems over time. These efforts should work towards a decrease in the nutrient and pollutant loading in the targeted needs areas.

6.4.2 *Needs Areas Recommended for Sewer Extensions*

As discussed in earlier sections, the Town has a centralized sewer system to collect flow from residents, businesses, and institutions, and conveys these flows to the municipal WPCF for treatment. The sewer system predominantly receives flow from the Marion Village area and other more densely populated parts of Marion. Wastewater is treated at the WPCF to produce a very high quality effluent, with very low nitrogen content, prior to discharge. Extending the sewer system to serve needs areas is an appropriate alternative to treat flow, as suggested in section 5.1.2.3. The needs areas have been determined as being poorly suited for long-term reliance on on-site wastewater treatment and disposal (septic) systems.

Based on the screening and evaluation of alternatives for wastewater management discussed in Section 5, the following unsewered areas presented in Table 6-3 (and depicted in Figure 6-3, attached), are recommended to be served by extensions of the public sewer system.

Table 6-3: Needs Areas Recommended for Sewer Extensions

Needs Area	Future Parcel Connected	Estimated Existing Flow (GPD)	Nitrogen Reduction from Current (lbs/day) [1]
River Road/ Wareham Road	82	12,700	3.3
Wings Cove / Piney Point	196	29,700	7.7
Lower Sippican Neck	38	5,900	1.5
Planting Island	79	12,400	3.2
Aucoot Creek	44	6,800	1.8
Lower Mill Street	111	17,200	4.4

[1] This nitrogen reduction assumes all existing flows are treated to meet 4 mg/l total nitrogen at the WPCF.

The above unsewered areas being recommended for sewer extensions have been priority ranked to determine recommended construction sequencing. The initial rating criteria for the needs areas included nitrogen loading and impairments, BOH variances, lot size, soil characteristics, and proximity to flood plains. The implementation ranking criteria also consider physical improvement needs (length of new sewer and downstream improvements needed), cost of implementation, flows and available treatment capacity at the WPCF, receiving water location of nitrogen impact reductions, and other subjective factors.

As discussed in Section 5, due to the distance between certain needs areas and the exiting sewer system, sewer extensions are less cost effective (on a per property basis) for smaller areas. The per parcel cost can be reduced by sharing infrastructure (particularly pump stations and force mains) and the associated costs. Because of these logistical considerations, it is recommended that Wings Cove/Piney Point, Lower Sippican Neck, and Planting Island be combined into one Needs Area for the purposes of extending sewers. Likewise, the Aucoot Creek and Lower Mill Street areas should be combined and considered one Needs Area for the purposes of extending sewers. These recommended sewer extension needs areas are depicted in Figures 6-4, 6-5, 6-6. Tables 6-4 and 6-5 present summaries of the necessary infrastructure and associated planning costs for each recommended sewer extension.

Table 6-4: Necessary Infrastructure for Sewer Extensions to Needs Areas

Needs Area	New Gravity Sewer	New Low Pressure Sewer	New Sewer Force Main	New Sewer Pump Station	New On-lot Grinder Pumps
River Road/ Wareham Road Area	4,900 ft	-	1,500 ft	1 PS	-
Planting Island, Lower Sippican Neck, & Wings Cove/Piney Point Area	18,700 ft	19,200 ft	12,300 ft	1 PS	151
Aucoot Creek & Lower Mill Street Area	8,700 ft	9,200 ft	4,500 ft	1 PS	70

It should be noted that the system layouts prepared as part of the CWMP are preliminary in nature and based on simplified available information. The Town should expect that certain details of the

recommended system will change during the final design of the recommended improvements. Similarly, the costs reflected in these tables for the area are planning level costs and are subject to change as the design of each area proceeds and more details of the areas are confirmed.

Table 6-5: Budgeted Costs for Sewer Extensions to Needs Areas

Needs Area	Approx. Construction Cost	Approx. Cost per Parcel
River Road/ Wareham Road Area	$2,300,000	$28,000
Planting Island, Lower Sippican Neck & Wings Cove/Piney Point Area	$14,000,000	$44,000
Aucoot Creek & Lower Mill Street Area	$7,000,000	$45,000
Approximate Total Construction Cost	~ $24,000,000 [1]	

[1] Total construction costs may range from ~$24M to ~$30M, as the cost of the combined Needs Areas may vary between the construction costs shown in Table 6-5 and their singular Needs Area costs shown in Table 5-42.

Before the Town moves forward with installing sewer extensions, further analysis is needed to confirm that both the existing sewer system and the existing WPCF have available capacity. As such, downstream improvements to the existing sewer system may be needed to extend sewers to these needs areas. As discussed throughout this CWMP, the Marion WPCF has limited treatment capacity available, with permitted effluent flow. With the additional flows projected from these proposed needs areas, the impacts also include a need for increased treatment capacity at the WPCF, as well as an increase in permitted effluent flow. In fact, the extension of sewers to these areas is subject to securing the additional permitted discharge capacity for the WPCF. If such additional capacity is not acquired, the extension of sewers to these recommended areas may not be possible.

To assist the Town of Marion with capacity planning and installation sequencing, each sewer extension area has been ranked based on priority of connection, as provided in Table 6-6. Priority ranking recommendations are based upon discussions throughout Section 5 of this CWMP, including items such as proximity to the existing sewer system and cost per area and per parcel.

Table 6-6: Sewer Extension Needs Areas Priority Sequence

Priority Rank	Recommended Sewer Extension Needs Areas
1st Priority	River Road / Wareham Road Area
2nd Priority	Aucoot Creek & Lower Mill Street Area
3rd Priority	Lower Sippican Neck, Planting Island, Wings Cove & Piney Point Area

Additional Evaluation of Localized Treatment Options

Addressing wastewater management in the recommended sewer extension areas is important to address issues with on-site wastewater disposal systems. It is possible that sewer extensions may not appear implementable in these areas – notably if WPCF capacity is not available, or if support is not present in the public for these improvements. The Town should consider further evaluation of localized treatment options if these issues prove to be barriers to sewer extensions. Notable is the option to evaluate a possible small remote treatment system to serve the Planting Island and Lower Sippican

Neck areas. The cost to advance the detailed evaluation (including location of a suitable site for facilities and groundwater discharge) of these areas may be relevant for future discussion in Marion. A budget in the range of $100,000 (for preliminary evaluation) to $300,000 (which would include some detailed permitting) should be considered for these efforts.

6.5 Existing Collection System Recommendations

The Recommended Plan for the collection system includes continued use of all gravity sewers, low pressure sewers, force mains and pump stations within Town. This section presents limited specific recommendations for these systems, as well as infrastructure prioritizations (where applicable).

6.5.1 *Sewer Collection System*

As wastewater systems age, the need for repair and modernization becomes more prevalent. In Marion, the collection system is subject to significant extraneous flows from infiltration and inflow (I&I), which occasionally (during wet weather and periods of high groundwater) taxes capacity of the WPCF. The Town has been performing I&I investigation and control measures for many years, and this work has seen increased emphasis over the past two decades. The effort to reduce the impacts of I&I on the system and to preserve (and restore) treatment capacity is a main driver for this CWMP, as is the need to modernize, protect and improve systems such as the sewer pump stations. The I&I investigation and control measures (currently implemented through the Annual Program) should continue within Town, and these are presently scheduled through 2029. Maintaining these regular efforts to reduce the impacts of I&I on the system is integral to preserving (and restoring) treatment capacity at the WPCF, and is necessary to meet the Town's current and future wastewater treatment demands.

In addition to the need for the continued I&I control efforts, there are a number of areas within the existing sewer system where access provisions should be improved to allow maintenance activities. These access improvement actions are important, and included uncovering buried and paved-over manholes, clearing access over sewer lines through cross-country (e.g., wooded or overgrown) areas, and acquiring or confirming legal easements to access sewer lines on private property. Table 6-7 summarizes the budgeted costs and prioritization for existing collection system improvement recommendations. As with other costs, the budget numbers should be reviewed and refined as the work proceeds (in the case of the annual I&I program, budget escalation over time will be needed).

Table 6-7: Existing Sewer Collection System Recommendations and Priority

Recommended Sewer Collection System Action	Cost of Improvement	Priority Rank
Infiltration & Inflow Control Program	Currently $200,000 annually	1st Priority
Sewer Access Improvements	Budget of $500,000	1st Priority

6.5.2 *Pump Station & Force Main Recommendations*

As presented in Section 4 and 5 of this CWMP, Marion's eight municipal sewer pumps are representative of the aging critical infrastructure that is common throughout the state and region. The following recommendations are not intended to address operations, maintenance, and immediate repair needs, as these needs are ongoing and require continuous attention. Those 'day-to-day' needs, while they may be significant, are expected to be addressed in the short-term, as part of the ongoing operation and maintenance (O&M) for the stations. The stated recommendations herein focus on the long-term (and 'bigger picture') needs for each of the pump stations.

6.5.2.1 General and Programmatic Pump Station Recommendations

The following general and programmatic recommendations are common to all stations or to Marion's overall system:

- All pump stations should be evaluated periodically to identify short- and long-term issues affecting the station's functionality. These detailed evaluations should include engineering considerations, review of operations conditions and functional capacity review.
- As discussed in section 6.3.3, a clear policy of required pump station criteria should be developed to prevent the construction and acceptance of sub-standard pump stations added to the system by developers or private sewer extensions. Refer to this section for more information

6.5.2.2 Pump Station Recommendation Summary

Short- and long-term recommendations for each pump station are summarized in Table 6-8. The below general recommendations for each pump station summarize the needs and alternatives presented in Section 4 and 5 of this CWMP. The order in which the pump stations have been placed serve as the recommended order each pump station improvement should be prioritized, and the general priority rank for each station is included.

Table 6-8: Short- & Long-Term Pump Station Recommendations

Pump Station	Priority Rank	Recommendations	Approximate Planning Level Costs [1]
Creek Road	1st	Complete Resiliency Replacement, Capacity Review	~$3,000,000
Silvershell	2nd	Capacity Review, Resiliency Reconstruction/Replacement, Safety Facility Upgrades, Procedural Changes	~$2,500,000
Front Street	2nd	Short-Term: Capacity Review, Safety Upgrades and Minor Renovations (Equipment), Procedural Changes	~$1,000,000
	2nd	Long-Term: Resiliency Renovation or Replacement	TBD*
Oakdale	2nd	Complete Replacement, Safety Procedural Change	~$1,500,000
Parkway Lane	2nd	Short-Term: Modernization/Renovation, Safety Upgrades/Procedural Changes	~$100,000
	2nd	Long-Term: Complete Replacement	~$1,000,000
Point Road	3rd	Capacity Review, Safety Facility Upgrades/Procedural Changes, Modernization/Renovation	~$1,000,000
Stoney Run	3rd	Modernization/Renovation	~$500,000
Littleneck	3rd	Modernization/Renovation, Safety Upgrades/ Procedural Changes	~$500,000

[1] Design of Creek Road PS improvements is complete and therefore the costs provided have a sound basis. The costs provided for all other stations are for preliminary budget purposes only. Scope of improvements must be confirmed prior to establishing updated budgets.

A few of the noted improvement needs are briefly described further as follows.

Capacity Review
Pump stations that are recommended for capacity reviews may have future flow connections from the need's areas discussed in sections 4.1.2 and 6.4.2. Detailed capacity reviews are recommended to be conducted for any pump station prior to connecting significant new flows to the system to ensure that there is adequate capacity to handle future sanitary flow.

Modernizations/Renovations
Based on the age of each pump station, equipment, including piping and valving, may be exhibiting signs of deterioration. For pump stations that are recommended for renovations, a short-term renovation of the PS may be needed (at a minimum), including replacement of the pumps and ancillary work.

Resiliency Need
Pump stations recommended for reconstruction/replacement have been identified as being located within a flood zone and/or hurricane inundation zone. Existing flood zones and future flood projections show that the station may need to be elevated to increase resiliency and protect critical features from future flood impacts.

Safety Needs
All of the Town's pump stations include confined spaces, such as wetwell areas, which are common for sewer pump stations. It is recommended that the Town develop safety protocols for access and maintenance. Specific training for pump station operators should also be included in this protocol for confined space entry and lockout/tagout. Additionally, the Town should consider other safety upgrades for each pump station, including those for guards on equipment, fall prevention, hazard communication and signage.

6.5.3 *Force Main Improvement Recommendations*

As all pump stations discharge through pressurized force mains, it is recommended that all force mains are assessed to determine repairs and implementation of protective actions. Assessment of larger, more critical pump station (Front Street and Creek Road) force mains should be prioritized (and assessment of Front Street force main has already proceeded). A summary of the Town's force mains recommended for evaluations to prioritize condition assessment, as well as the current recommendations are provided in Table 6-9.

Table 6-9: Force Main Recommendation Summary

Force Main	Installation Year	Size & Material	Ultimate Recommendation Depending on Condition Assessment
Front Street	c. 1970	14-in CI 12-in DI	Addition of second (redundant) parallel force main
Creek Road	c. 1972	8-in CI	Repair or Addition of second (redundant) parallel force main
Silvershell	c. 1960	8-in AC	Complete Replacement
Oakdale[1]	c. 1993	4-in DI	Develop inspection program to analyze condition every 5 to 10 years

Notes: [1] No records of the exact force main location are available, and easements are not known to exist for the force main alignment. Some location test pits were performed in 2022. Proper easements should be obtained to ensure access for maintenance activities.

Detailed costs for the force main recommendations have not been prepared. The cost for the redundant force main to serve the Front Street PS is included in the WPCF recommendations later, as this is a key resiliency recommendation for the WPCF. Costs to assess repair, and/or replace the other force mains are likely to range from $1,000,000 (likely for the Silvershell force main alone) to $2,000,000.

6.6 Wastewater Treatment and Disposal Recommendations

As detailed in the prior sections of this planning report, significant improvements are needed at the WPCF. These improvements are driven by several major factors – additional capacity needs to support future sewer extensions, pending changes to the various regulatory permits and orders (as issued by the U.S. EPA and Massachusetts DEP), and the general need for modernization and capital restoration of the WPCF resulting from age and condition of the WPCF systems. These needs are supplemented by opportunities for improvements in efficiency, operability, resiliency and reliability. The overall goal is to improve the WPCF to a condition and capability that will provide for Marion's needs for the next 20 years.

6.6.1 *WPCF Improvements and Phasing*

In general terms, the WPCF recommendation is to provide for capital improvements to the facility to allow the WPCF to meet future system capacity, regulatory, efficiency, modernization and resiliency needs, and to generally restore the facility life. The recommended WPCF improvements are presented as follows. For some recommendations, a discussion of possible phasing priority is presented to help with sequencing of projects to address affordability of the recommended plan.

6.6.1.1 Major Recommended WPCF Improvements

As discussed in Section 5 of this CWMP, the most feasible alternatives were presented to provide options for addressing the 'big picture' needs for the WPCF. Upon review and discussion with Town officials, Alternative A2 is being recommended as the most feasible alternative to ensure that the WPCF is a robust and resilient treatment system that will meet the Town needs and permit conditions into the future. The primary focus areas of the Alternative A2 recommendation are: (1) to meet current regulatory requirements for phosphorus, and (2) to expand the existing WPCF infrastructure to include the addition of a third SBR tank to support treating additional flows. Capital costs for these improvements are provided in Table 6-9. Recommended Alternative A2 improvements generally include:

- Improvements to meet phosphorus permit limits, including chemical precipitation and related upgrades.
- Source control management approaches to address copper permit limits.
- Construction of a new, third SBR tank with ancillary work, and modifying the process controls to allow the treatment of additional flows.

In addition to these improvements related to capacity and current permit conditions, further improvements to biosolids (sludge) management are recommended. Improvements recommended to the solids handling systems include thickening on site and disposing the biosolids off site (instead of the current practice of using only the on-site lagoons for storage and disposal of solids). To thicken solids on site using a gravity thickener requires a significant, but not cost-prohibitive investment. All of these major WPCF improvements are summarized in Table 6-10, along with a priority rank for order of completing the improvements.

Table 6-10: Process Improvements & Optimization Capital Cost Summary

Description of Improvements	Capital Cost	Priority
Improvements for chemical precipitation system to meet phosphorus limit Source control to address copper limit	~$1,000,000	1st
Construction of new, third SBR tank with ancillary work	~$3,500,000	2nd
Biosolids improvements, including new gravity thickener	~$2,000,000	3rd
WPCF Improvements Capital Cost	**$6,500,000**	

The most challenging aspect of this recommended alternative is the need for a NPDES permit modification allowing an increase in the flow limit on treated effluent. With the recently lined lagoon, the WPCF has the current ability to consistently treat flows above the current flow limit of 0.588 MGD. The addition of the third SBR adds an additional degree of resiliency to the process will reduce the reliance on the lagoons, and also allow the WPCF to consistently treat significantly higher flows. Table 6-11 below provides a summary of the recommended Alternative A2's effectiveness in addressing needs at the WPCF. This table includes the summary effect of the recommended biosolids improvements as well.

Table 6-11: Recommended Process Improvements Effectiveness

WPCF Need	Effectiveness at Addressing Need
Capacity	Good. Provides additional capacity needed. Requires NPDES permit increase in effluent discharge limit
Nitrogen	Good. Will continue to require a high level of nitrogen reduction. Additional nitrogen load will be mitigated by non-point source removal.
Phosphorus	Good. Phosphorus removal will be provided.
Copper	Limited. Copper removal will be addressed by source control.
Bio-Solids Management	Good. Provides improved biosolids management through thickening and disposal.

6.6.1.2 WPCF Ancillary Improvements

Beyond the major improvements summarized above, the WPCF will require a range of miscellaneous improvements to address system age, condition, modernization, and efficiency. These ancillary WPCF improvements recommended for the WPCF provide a comprehensive capital improvement program (CIP) for the facility. Such a comprehensive CIP typically has a significant capital cost to implement. Planning level costs were developed for each recommended capital improvement to the WPCF. As these improvements include some higher priority repairs as well as some longer term needs, the relative priority of these should be discussed and confirmed with the WPCF management team. Preliminary recommended priorities (based on initial discussions of the urgency of each improvement) are included in Table 6-12, which also summarizes planning level cost information.

Table 6-12: WPCF Auxiliary Needs and Cost Summary

Treatment Area	Treatment Recommended Improvement	Auxiliary Capital Cost	Priority
Influent Pumping	Front Street PS force main redundancy	$2,000,000	1st
Headworks	Miscellaneous headworks repairs	$250,000	1st
	Biofilter media replacement	$50,000	2nd
	Upgrade of soda ash system	$100,000	2nd
SBR	Concrete repair for SBR tanks	$500,000	1st
	Scum improvements	$200,000[1]	3rd
	Replacement of submersible mixer rails	$60,000	2nd
	Addition of water hydrants near SBR basins	$50,000	3rd
	Replacement of SBR mounted DO probes and display systems	$30,000	2nd
Instrumentation & Control	Review of general control systems	$35,000	2nd
	Radio telemetry system communicating with the sewer pump stations	$100,000	2nd
	General upgrade to instrumentation and I&C systems	$300,000	2nd
Main Operations Building	Vehicle and trailer storage	$1,500,000	2nd
	Floor repair garage (ceiling in blower room)	$100,000	1st
Disk Filter Building	Replace pumps at Side Stream PS	$100,000	2nd
	Concrete evaluation for wet well at Side Stream PS	TBD [2]	1st
	Safe access equipment in two filter bays	$100,000	2nd
UV Disinfection	Architectural improvements to sealing work around the building envelope	$125,000	2nd
Lagoon System	Assess sludge and lagoon support systems in Lagoon No.2 (and Lagoon No.3 as appropriate), and complete any required improvements [3]	TBD [2]	2nd
Flow Metering	Replace effluent flow meter system (relocate downstream of effluent filters)	$150,000	3rd
Buildings & Site	Installation of vactor truck dump station with diversion to headworks [4]	$200,000 [4]	3rd
	SCADA Fiber optics between buildings	$500,000	3rd

[1] Preliminary design will be required to determine the nature of scum improvements. The cost provided is a budget figure.
[2] "TBD" costs require additional scoping and as such no capital cost estimations are provided in this table.
[3] The assessment of lagoons 2 and 3 should be planned in coordination with the progress of the High Flow Management Plan required by the regulatory ACO/AOC. Actual improvements, if appropriate, should be deferred at least long enough to determine the future need for (and use of) these additional lagoons.
[4] Recommendations for the new vactor dump and preliminary treatment should be revisited as part of the long-term solids handling plan.

6.6.2 *Permit & Regulatory Requirement*

6.6.2.1 NPDES Permit Expiration and Renewal Recommendations

The current NPDES permit for the Marion WPCF is scheduled to expire on November 30, 2022 (though under the NPDES program the permit remains in force until a new permit is issued). The Town applied for renewal of the permit on June 3, 2022, and resubmitted with updated information (as requested by EPA) on August 1, 2022. On September 13, 2022, the Town was contacted by EPA confirming that the application was complete. In the application, the Town requested consideration by EPA to increase the NPDES permit discharge capacity for the WPCF to 0.686 MGD, consistent with this CWMP.

In late October 2022, EPA issued a new Modification to its 2021 General NPDES Permit for Small Wastewater Treatment Facilities; and this draft modification proposed the addition of Marion under this 'Small General Permit'. The Town is presently reviewing the Small General Permit Modification in detail, and comments are due on this permit in late January 2023. Notably, the inclusion of Marion in the Small General Permit ignores the request submitted by Marion for additional discharge capacity under its NPDES authorization. The possibility of modifying the Small General Permit from its draft form exists, as does the potential to request a new individual NPDES permit. Further discussion with EPA is needed to ensure the permit supports known Town needs, before the final permit is issued.

Permitted Flow

While "flow" is not a pollutant per se, EPA has included a limit of average monthly flows in the permits issued in Massachusetts. The treatment and discharge capacity for the Marion WPCF is limited by the existing treatment processes and the NPDES discharge permit for the facility. Without action from the Town, EPA is expected to continue issuing future permits for the Marion WPCF with an average monthly flow limit of 0.588 MGD, based on a 12-month rolling average. Beyond the discharge permit limit, the WPCF is limited by the functional operation of the sequencing batch reactor (SBR) process, and the facility's ability to meet the strict discharge permit limits during periods of higher flows. These processes effectively limit the treatment capacity of the facility to a maximum daily flow. While the theoretical design of the WPCF targeted a maximum daily capacity of approximately 1.20 MGD, the actual functional capacity of the facility is currently estimated at a maximum daily capacity of approximately 1.05 MGD. The projected capacity needs for the Marion WPCF are summarized in Table 6-13.

Table 6-13: Future Flow Considerations

Flow Description	Average Daily Flow (MGD)
Existing Flows (Avg. 2017 – 2021)	0.515
Infiltration & Growth in Sewered Areas	0.050
Sewer Extensions (Recommended)	0.091
Planned/Anticipated Development	0.030
Proposed Future Daily Flow to WPCF - TOTAL	**0.686**

The future capacity needs at the WPCF exceed the current treatment and discharge capacity. Based on the flows and load projections summarized in this report, the Town will require a higher flow limit in its next NPDES permit. If additional flow capacity is not granted by EPA, the proposed sewer extension areas will need to remain served by on-site (septic) systems, which will result in continued higher nitrogen loads to Marion's coastal waters.

BOD and TSS

As discussed in previous sections of this report, the Town has requested higher discharge flow limits. If granted, BOD and TSS load limits will be expected to be maintained in the new permit. This would mean that the WPCF will need to achieve equivalently lower concentrations at the higher flows to keep the loadings consistent. Due to this constraint, the updated draft NPDES permit criteria should be reviewed and discussed with EPA before the permit is finalized to verify that the WPCF can meet these limits.

Nitrogen
As with BOD and TSS, if the Town is granted a higher discharge flow limit, the load limits for ammonia nitrogen and seasonal total nitrogen would typically be expected to be maintained. However, the recommended plan proposes to provide nitrogen mitigation for the coastal waters by removing septic systems from service in these coastal tributary areas. This mitigation action will significantly reduce total nitrogen loads, offsetting any load increase from the WPCF outfall. Based on this mitigation strategy, the Town suggest that there is no need to meet lower effluent concentration limits (below the 4 mg/l total nitrogen limit and equivalent load limit currently in place). If a change to a higher discharge flow limit requires the WPCF to meet equivalently lower concentration limits at higher flows, then reconsideration of proposed sewer extensions may be needed. Permit criteria should be reviewed and discussed with EPA before a new permit is finalized to verify that the WPCF can meet these limits.

Phosphorus
The regulatory orders (AOC and ACO) currently in place include a stay on the requirement for the Town to meet the current phosphorus limits (refer to Section 3.3.6 and 5.3.1.3), and instead requires reporting only of effluent phosphors. The stay includes the provision for the Town to participate in planning for and evaluation of regional treatment options (which, as discussed previously in this report, could eliminate the need for a discharge permit for the Marion WPCF). If the Town concludes that regionalization is no longer a realistic option, the stay on the total phosphorus limit will be lifted and the WPCF will need to make future provisions for treatment of phosphorus. Such improvements are included in the WPCF recommended plan described above.

Copper
The Administrative Order (AO) currently in place includes a stay on the current limits, as well as an interim copper limit of 20 ug/L. Barring a change in the discharge location, the Town should expect that the interim copper limit will lapse and more stringent NPDES permit copper limits will continue to be a part of future permit conditions. The recommended plan currently proposes to meet the NPDES copper limits through an enhanced source control approach.

Other pollutants and permit considerations will need to be evaluated, and new provisions to address monitoring for PFAS compounds will be included in any new permit. Following the final implementation of phosphorus precipitation process at the WPCF, EPA will also consider the Reasonable Potential for the facility to require an effluent limit on aluminum. Notable other new NPDES permit provisions will include enhanced ambient condition testing in the receiving stream.

6.6.2.2 Regulatory Compliance AOC/ACO/AO

Marion currently has three regulatory consent orders/agreements (AOC, ACO, and AO) related to its WPCF which place limitations and requires on the facility operation and require certain actions by the Town (these notably included the improvements to lagoon No. 1, which are near substantial completion as of late 2022). The Town of Marion should continue steps to comply with and resolve any remaining actions required under these existing consent orders from EPA and MA DEP. Ultimately, the regulatory enforcement orders should be settled, and the Town should move forward with the WPCF discharge permit(s) governing regulatory requirements.

6.6.2.3 WPCF Resiliency and Sustainability

The Recommended Plan for the WPCF will improve general resiliency and sustainability for the facility. As discussed in Section 4 and 5, a primary area for concern for WPCF resiliency is the lack of resilient staffing plan in place. In the event that one or more of the limited number of operations staff are incapacitated or unavailable, an alternate plan to continue to safely operate and maintain the system should be put into place.

Additionally, the disposal of solids from the process is recommended to be explored further to improve sustainability, as long-term storage of solids in the lagoons have been found to be problematic. Otherwise, the overall recommendations to continue reliance on the Marion WPCF at its current site, including the plan to increase discharge permit capacity, is viewed as having good long-term sustainability. Energy efficiency considerations should continue to be explored for the WPCF. The tighter permit limits, including the implementation of phosphorus treatment, will lead to higher energy costs, increased chemical use, and increased sludge generation. However, EPA does not consider overall sustainability in its permit setting procedures, so these additional expenditures appear unavoidable. Discussions involving the Select Board, Town Administrator, and the Wastewater Department are recommended to determine next steps.

6.6.2.4 Effluent Reuse

As recent weather patterns in New England have reminded us, water is an increasingly scarce resource. This scarcity is true in the Marion area – and throughout the Buzzards Bay region. Water resources need careful management and conservation to ensure the best future availability of water locally. One step that Marion can take is to seek opportunities for reuse of treated effluent to supplement the need for clean public water. Effluent reuse is an appropriate step for communities where highly treated effluent can be generated that meets the Massachusetts water reuse standards, and where applications for safe reuse exist in the community. Notable reuse options include irrigation and landscape watering, industrial water uses (e.g., cooling water), institutional and commercial toilet flushing, and indirect reuse through aquifer recharge.

Based on the stringent effluent quality currently being required in the Marion WPCF discharge permit, the Town is encouraged to conduct designated studies for possible effluent reuse for planned new and redevelopment in Marion to determine feasibility. For example, the commercial and industrial use parcels lying north of Benson Brook Road and west of Mill Street (Route 6) may offer some opportunity for limited effluent reuse. Such properties could use treated effluent for general irrigation and landscape watering. Treated effluent can provide added benefits when used for landscape watering, as it contains nutrients (nitrogen and phosphorus), which are beneficial to support plant growth. Such reuse could be a positive step for Marion and would help to reduce permitted discharges to the surface waters. As irrigation uses primarily occur during the dryer summer months, the contribution of these practices can limit demand on potable water supplies, while helping to protect groundwater levels and sustain local water balances.

6.6.2.5 Groundwater Discharge

Groundwater disposal is becoming more common in Massachusetts for collected wastewater from significant developments and may be an option for Marion for the future additional capacity needed at the WPCF, assuming an increase in the NPDES surface water discharge permit cannot be obtained. Groundwater disposal involves the discharge of highly treated effluent from a wastewater treatment facility into an infiltration bed or subsurface distribution system. While disposal of all WPCF effluent is

not considered feasible for Marion, a supplemental groundwater discharge at the WPCF site may be possible. Feasibility of developing a groundwater discharge effluent disposal system at the Marion WPCF can be determined by conducting a detailed study that assesses the hydrogeologic conditions at a selected site relative to the assimilation potential of the local subsurface environment to accept treated wastewater. Depending on the results of such a study, a Groundwater Discharge Permit application can be submitted to the Massachusetts Department of Environmental Protection for the possible use of the disposal system at the selected site. Any significant new groundwater discharge of treated wastewater would also require coordination through the MEPA environmental review process.

6.6.2.6 Source Control of Pollutants

Copper is one of the contaminants of concern at the Marion WPCF, both currently and for future anticipated discharge permit requirements. While there are processes for treating to remove copper that could be added to the WPCF, Marion should continue the source control implementation measures currently in place. These include increasing the pH of the water supply and using chemical additives prior to distribution. This effectively contributes to reductions of copper in the WPCF influent, without needing to include new maintenance intensive WPCF processes to meet permit limits in the effluent.

Source control should also be considered for new pollutants, including PFAS-containing substances, as the new NPDES permit for Marion will require monitoring of such compounds. The Town will need to track the progress of environmental regulations limiting the use of PFAS containing compounds in industrial practices and consumer goods, and may need to undertake further control actions as the relevant regulations are finalized.

6.6.2.7 Regionalization

Regionalization with Wareham was evaluated in Section 5 of this CWMP. Compared to the other alternatives, regionalization has a moderate (or lower) likelihood of being successfully implemented. Beyond the high costs, there are many challenging aspects of regionalization, including the extensive regulatory, permitting and inter-governmental coordination, the known and unknown obstacles to the outfall extension, and the significant risk of unforeseen costs related to construction, particularly related to unknown subsurface conditions long the long pipeline routes. The regional concept also currently lacks sustainability and resiliency benefits, as compared to other options for the Town. Despite the identified drawbacks of this regionalization option, the proponents of the plan (including the Buzzards Bay Coalition) are continuing efforts to improve the plan and address project affordability. Recent discussions have been cooperative, and the Town of Marion should continue to participate in the regionalization planning process as it proceeds.

The Town should also continue to discuss possible coordination of sewering activities for the areas around Aucoot Cove with the Town of Mattapoisett. While it appears that Mattapoisett will be proceeding separately with sewering their portion of this needs area (the developed area lying along the western shore line of the cove), future possible collaboration should continue to ensure that the nitrogen load to Aucoot Cove from septic systems can be eliminated.

6.7 Environmental Impacts

This section provides a discussion of the potential direct and indirect environmental impacts that are anticipated in relation to implementing the CWMP Recommended Plan.

6.7.1 *Direct Environmental Impacts*

Direct environmental impacts relate to the implementation of the wastewater management alternatives and occur either temporarily during construction or permanently as a result of the improvements. Direct impacts may include disturbance of sensitive historical, archaeological, cultural or recreational areas, disturbance of wetlands and plant species habitats, impacts on surface water and groundwater quality, and impacts to normal traffic, business operations or other daily activities in the project area. In general, the Recommended Plan has been selected to limit long-term environmental impacts as much as possible.

- *Wetlands and Floodplains*
  There are a number of wetlands and floodplains within Marion including those bordering the location of the existing WPCF and numerous pump stations. The impact of the recommended plan to sewer additional needs areas should be positive with regard to groundwater quality (and hence recharged of wetlands) once failing septic systems are removed from service. Wetland areas provide valuable wildlife habitats. Excess nutrients leaching into wetlands and floodplains from poorly functioning septic systems can cause water quality degradation and excessive plant growth, which can lead to reduced storage for floodwater retention, and can cause floodwaters to overtop banks. Wetland wildlife, such as macro invertebrates, can be sensitive to nitrogen and dissolved oxygen levels. Additionally, wetlands are a natural filtering system for groundwater, and these areas therefore protect the downstream coastal waters. The Town of Marion relies on groundwater for its water supply and so protection of the wetland areas is a priority for the Town.

  Temporary wetland and floodplain impacts associated with construction will be considered during the final design of all recommended plan items. All work will be identified in a Notice of Intent (NOI) to be submitted to DEP and the local Conservation Commission for approval. As a minimum, siltation control measures will be used in these areas during construction to mitigate any potential impacts. The majority of the proposed work for sewer extensions are within existing roadways and should not create any permanent impacts.

- *Groundwater*
  The presence of failing septic systems has a negative impact on the Town's groundwater resources. Even fully functional on site (septic) systems discharge significant pollutant loads to the groundwater. The Recommended Plan will improve groundwater quality by eliminating failing and inadequate on-site sewage disposal systems.

- *Surface Water*
  Implementation of the recommended plan for both WPCF upgrades and sewer extensions will provide protection of surface water quality. Recommended upgrades at the WPCF were driven by expected new permit conditions, requiring increased phosphorus removal and maintaining a high level of nitrogen removal from the WPCF effluent. The treatment will be protective of the waters downstream of the WPCF, including the Effluent Brook which then flows into Aucoot Cove. Reliability and resiliency improvements at the WPCF will further protect the receiving waters, and ultimately Buzzards Bay.

  Sewer extensions will provide for the elimination of failing on-site wastewater disposal systems, and their nitrogen and phosphorous contributions in the project area. Conveying wastewater to

the WPCF will help to eliminate the potential for untreated or partially treated sewage from negatively impacting surface water bodies. The Recommedned Plan will result in improved surface water quality throughout Marion including enhanced protection of the Weweantic River, Sippican River, Aucoot Cove, Aucoot Creek, Hammetts Cove, Sippican Harbor, Blankenship Cove, Planting Island Cove, and the "Inner" Sippican Harbor.

The project will remove or reduce potential sources of pollution in the form of nutrients, turbidity, and bacteria/pathogen sources; and will thereby help protect the surface water resources in the project area. Once shoreline residences are tied into the sewer, phosphorus and nitrogen entering rivers, coves, harbors and adjacent streams will be reduced. By reducing the (nutrient) pollutant loads to these waters, the overall Recommended Plan will help toward restoration of designated uses, and further protect the designated water uses in the future.

- *Displacement of Traffic, Households, Businesses, and Services*
  Since the proposed sewer alignments are within existing roadways, there will be impacts on vehicular traffic patterns. Traffic impacts due to increased volume from construction vehicles will be seen and roadway construction may have some short-term effect on existing traffic patterns. To minimize these effects, construction documents should require, when and wherever possible, provisions that all work should include provisions for maintenance of at least a single lane of traffic. Adequate traffic controls shall also be provided. Impacts to businesses and traffic will be limited, and traffic control measure will be in conformance with requirements. In sewer extension areas, short-term traffic impacts related to construction should be offset by long-term reduction in traffic to maintain, repair and replacement septic systems in these areas.

- *Air Quality and Noise*
  The major impacts to air quality and noise would be short-term due to construction and equipment operation. Sensitive air quality and noise receptor sites, such as residential areas, schools and elderly housing will be identified, and appropriate mitigation will be implemented prior to construction. There will be designated work hours to minimize noise and nuisance impacts on residents. Construction equipment will also be equipped with proper devices for noise reduction. In addition, watering of construction sites will be utilized to control the amount of dust generated. No long-term impacts are anticipated with respect to noise and air quality as the project area is already very densely developed.

- *Vegetation and Wildlife*
  To minimize impacts to vegetation and wildlife habitats, the use of existing roadways for the installation of pipelines has been maximized. NHESP Priority Habitat of Rare Species is located within four of the sewer needs areas. These areas may be temporarily impacted due to construction related activities; however, no permanent alteration of these habitats will occur. All work is within existing paved areas or at the existing WPCF site. Where work will occur within or adjacent to such habitat, coordination through the NHESP will be performed as projects proceed through design and into construction.

- *Energy Impacts, including Energy Efficiency and Energy Management*
  The Marion wastewater collection and treatment system includes many components that are outdated and in need of modernization. As such, these systems offer opportunities to improve

energy efficiency. The most notable areas identified for possible energy savings through the planning work include the following:

- Marion WPCF – Major process equipment uses significant energy resources on a continuous basis. The best opportunities for improvements include air blowers and pumps, where efficient motors and variable speed drives, combined with smart control logic mitigate major energy use. In addition, process selection can affect energy conservation – the current SBR process has a relatively low energy impact. While the cloth media disk filter system has a slightly higher energy requirement, the discharge permit limits require the use of these systems to produce high quality effluent. Due to the need to begin phosphorus removal at the WPCF, energy needs could increase marginally in the future. WPCF building heating, ventilating and lighting systems will be improved where opportunities exist for such improvements.

- Sewer Pump Stations – Sewer pumping systems offer the same opportunities for improving efficiency of pumping equipment. All future pump station improvements will include new technology to control energy use, including as a minimum, variable frequency drives. Similarly, building heating, ventilating and lighting systems will be improved where opportunities exist for such improvements.

Opportunities for positive energy management steps will continue to be present in Marion, as well as possible opportunities to implement some renewable energy strategies. The Town should continue to identify and pursue energy management as a means to control operational costs and conserve resources. The Town should generally include energy savings and management as specific goals in each of their projects going forward, including, as a minimum:

- Selection of processes that offer the best profile for long-term annual energy costs – as an example, treatment processes that are high energy consumers should be avoided, if possible.
- Unless technical reasons prohibit such an approach, providing for premium efficiency motors in all process equipment in the water and sewer systems. This would be incorporated into sewer pump station projects, and wastewater treatment projects.
- Unless technical reasons prohibit such an approach, providing for variable speed drives (a.k.a. variable frequency drives, or VFDs) in all process equipment in the sewer systems.
- Where applicable, improving building envelopes to provide for more energy efficient heating and cooling of structures, process areas and personnel space.
- Where applicable, improving building heating, ventilating and air conditioning (HVAC) systems to improve energy efficiency, including the use of modern climate control systems.
- Where applicable, refitting all buildings and sites with new energy efficient (LED or similar) lighting systems.

- *Greenhouse Gases*
  Upgrades to WPCF and sewer pump stations will include improvements in energy efficiency, as discussed above. In addition, the proposed sewers extensions are expected to reduce the number of septage hauler vehicles and thus decrease fuel usage and their emissions. These reductions will significantly offset additional energy use to treat the flows at the WPCF. More importantly, the effect of the treatment at the WPCF will remove more nitrogen from the coastal

waters than the current on-site (septic) systems. Vehicle emissions from construction activities will likewise be offset by a reduction in continuing septic system maintenance, repair and replacement activities within the sewered neighborhoods.

The review of alternatives considered energy and related greenhouse gas impacts, and the selected improvements are reflective of lower impacts than the non-selected alternatives. In general, the activities included in the Recommended Plan will be implemented to limit greenhouse gas production to the degree feasible.

6.7.2 *Indirect Environmental Impacts*

Indirect environmental impacts result from induced changes in the patterns of land use and population growth. Specific indirect impacts of the recommended plan could include growth and development.

- *Growth*
  The main goal of the project is to extend sewer service to environmentally sensitive and susceptible areas and limited developed areas with failed and substandard on-site disposal systems. In general, the installation of wastewater collection systems can sometimes result in limited induced growth. This growth results from the development of a limited number of properties that were previously challenged due to site constraints that prevented (or hampered) the installation of on-site wastewater disposal systems. In the Marion recommendations, this problem will be mitigated with the installation of sewers in areas that have existing wastewater needs. These areas are already densely developed and offer generally limited potential for major additional dwelling units. Most of the residential areas are already near to their full development condition, with a limited developable residential lots remaining in the project area. Therefore, future negative impacts from unwanted growth are not expected to result from implementation of the Recommended Plan.

6.7.3 *Summary of Environmental Considerations*

Based on the above discussion, the recommended plan has been evaluated for its anticipated environmental impacts. Despite some temporary, construction-based, environmental impacts, the effects of upgrading the treatment capability of the WPCF to meet permit requirements and expanding sewers to key needs areas across Marion should result in long-term environmental and public health benefits to the community by improving ground and surface water quality.

7.0 IMPLEMENTATION & FINANCING

This section of the CWMP includes information on the steps needed to implement the recommendations of the plan, and options for the financing and funding of capital project costs. Implementing the recommended programs and improvements will present challenges – including administrative management and financial challenges. The Town of Marion will need to make decisions throughout the implementation process to ensure that the recommendations meet local needs.

7.1 Implementation Considerations

The Town will need to take a number of key actions to implement the recommendations of the CWMP. The timing of these implementation steps will be subject to local decision-making. These implementation steps are generally presented in chronological order within each sub-category (as follows), but the individual actions should be coordinated as implementation of various CWMP recommendations progresses.

Stakeholder and Public Communication

- Complete the local review and discussion of the CWMP with stakeholders and the public to refine recommendations and build support for implementing the Recommended Plan.
- As capital improvement projects are implemented under the CWMP, the Town should continue a regular system of public information and stakeholder discussions, to keep local stakeholders aware of, and involved in, the ongoing implementation.

Regulatory and Permit Actions

- Regulatory AOC/ACO/AO Actions – Continue steps to comply with and resolve any remaining actions required under the existing Consent Orders from EPA and MA DEP. Ultimately, the regulatory enforcement orders should be settled, and the Town should move forward with the WPCF discharge permit(s) governing regulatory requirements.
- Marion WPCF NPDES Permit - Complete the EPA NPDES permit renewal process (underway as on 2022), including securing additional discharge capacity under the permit.
- MEPA Approval – Engage and complete the MEPA process to ensure consistency of the recommended plan actions with the Massachusetts Environmental Policy Act (MEPA).
- MA DEP GWDP – If necessary, seek preliminary and final approval for a groundwater discharge permit (GWDP) from Massachusetts DEP for the disposal of treated effluent to the ground.
- Individual Project Permits – Identify necessary permit steps for each project to be implemented and complete the relevant permitting processes.

Funding and Financing Actions

- Local Funding – Appropriate local funds to complete recommended actions through the annual budgeting and Town Meeting process.
- Local Sewer Use Rate Setting – Review the annual wastewater fund budget and revenues each year, and assess the adequacy of current user charge rates and related fees. The Town should adjust rates and fees annually to address inflation and ensure adequacy for project cost needs.
- SRF Financing PEF – For capital projects, prepare and submit annual Project Priority List applications - Project Evaluation Forms (PEF) to Massachusetts DEP. These are generally filed in August of the calendar year preceding the year in which the project would be implemented.
- SRF Financing Final Application – For capital projects, prepare and submit final applications for SRF funding to Massachusetts DEP and the Clean Water Trust. These applications are generally

due no later than mid-October in the calendar year for which projects are listed on the SRF Project Priority List (PPL)/Intended Use Plan (IUP).

- Grant Program Funding – Identify grants to fund eligible projects and prepare applications with supporting documentation as necessary to acquire grant funds.
- Project Reserve Funds – For implementation of larger projects and to meet capital replacement needs, build and maintain a capital reserve fund within the sewer enterprise system.

Local Policy Actions

- Sewer Betterments and Sewer Connection Fees – Review the current system for assessing costs to properties that newly connect to the sewer system. This includes establishing appropriate betterments for Town-initiated projects, and connection fees and/or capacity fees for individual and developer connections to the system. This should include calculating the full costs for the Town of Marion to provide the requested service. The Town should periodically adjust the costs assessed for new connections to reflect actual current costs to provide such service.
- Private Sewer Policy – Review, deliberate and agree on adjustments to the current policy on the extension of private sewers in Marion. Implement policy changes through the public review process.
- Individual Grinder Pump Maintenance Policy – Review, deliberate and agree on adjustments to the current policy on the maintenance and replacement responsibilities for individual grinder pumps installed as part of Town sewer extension projects. Implement policy changes through the public review process.
- Sewer Regulations – Review the current policies and procedures for the local sewer system, and the governing regulations. This should include reviewing procedures for connections and requirements for applicable fees to be paid.
- If pursuit of zero interest loans through the SRF program is desired by the Town, local land use controls will need to be developed, approved, and adopted to secure funding eligibility.

Constructing Capital Improvements

The capital improvements recommended in the CWMP should be prioritized and implemented through a phased approach over the planning period.

7.2 Financing and Funding

There are a variety of funding sources available to assist with capital project costs for municipal projects. The most applicable funding is the State Revolving Fund (SRF) program, which is administered by Massachusetts DEP, and will fund water, stormwater and wastewater projects. A general discussion of the funding program is presented here. After funding is determined for the project, decisions must be made on the local allocation of costs. This is crucial as there are very limited opportunities for grant funding, and project funding will consist primarily of loans. For the purposes of this report, we have focused this discussion on the funding and financing of the capital project recommendations of the CWMP

7.2.1 *SRF Financing*

The primary mechanism in the Commonwealth of Massachusetts for financing public wastewater projects is currently the State Revolving Fund (SRF), as administered by the Massachusetts DEP and the Massachusetts Clean Water Trust (MCWT, or the Trust). This program provides assistance to cities and towns in the form of low interest loans to cover eligible project costs. The current program in Massachusetts provides for loans at an interest rate of 2% per year for a 20-year bond, which is lower

than the current interest rates otherwise available to the Town for municipal bonds. Based on information provided by the Town's fiscal agent, the likely current bond rate would be 4%. SRF financing can cover the eligible construction costs of the project, including the cost of engineering during construction, but related costs for design are generally not eligible under the program. To apply for funding, a Project Evaluation Form (PEF) must be submitted. A competitive process for rating projects occurs annually, and the projects that demonstrate the highest needs and most complete planning are made eligible for funding by placement on the state's Intended Use Plan (IUP).

In addition to the standard interest rate of 2%, there are also 0% SRF loans available for certain projects. The zero percent loan program was developed to assist municipalities with projects focused mainly on the environmental control of nutrients – which, in the case of Marion, is the primary driver for the most expensive plan component, the WPCF improvements. To apply for the 0% interest rate, the following additional criteria must be met by the project and applicant:

- The project is primarily intended to remediate or prevent nutrient enrichment of a surface water body or a source of water supply.
- The applicant is not currently subject, due to a violation of a nutrient-related total maximum daily load standard or other nutrient based standard, to a MassDEP enforcement order, enforcement action by the United States Environmental Protection Agency, or subject to a state or federal court order relative to the proposed project.
- The applicant has a Comprehensive Wastewater Management Plan (CWMP) approved pursuant to regulations adopted by MassDEP.
- The project has been deemed consistent with the regional water resources management plan, if one exists.
- The applicant has adopted controls, subject to the review and approval of MassDEP in consultation with the Department of Housing and Economic Development. Furthermore, where applicable, any regional land use regulatory entity, intended to limit wastewater flows to the amount authorized under the land use controls that were in effect on the date the Secretary of the Executive Office of Energy and Environmental Affairs issued a certificate for the CWMP pursuant to the Massachusetts Environmental Policy Act, M.G.L. c. 30, §§ 61-62H, and the MEPA regulations at 301 CMR 11.00.

Legislation also limits the cost of loans available at 0% to thirty-five percent of the Clean Water State Revolving Fund (CWSRF) IUP capacity in any given year. For example, a $300M CWSRF IUP could finance up to $105M at 0% interest. If eligible projects for 0% interest loans in excess of $105M are proposed, MassDEP will afford the zero percent interest rate to projects in rank order as listed on the IUP. In that instance, highly ranked projects that are eligible would be financed at zero percent, while lower ranked eligible projects would receive the standard 2% interest rate.

The Town of Marion will need to decide on a final strategy for pursuing project funding, including the possibility of pursuing zero percent loans through SRF. Several of the Recommended Plan elements would likely meet the zero interest SRF loan requirements based on their scope targeting nutrients in Buzzards Bay. This would most likely include the sewer extensions to needs areas, and some of the proposed WPCF improvements. However, since a zero-interest rate is not guaranteed, loan repayment costs in this section have been calculated assuming that a 2% interest SRF loan would be obtained. In addition, the community has not addressed the land use controls that are also required in accordance with Section 23 of Chapter 259 of the Acts of 2014, to access zero interest loan funding. This latter

requirement will be one of the more significant decisions to be made by the Town in implementing the CWMP recommendations.

The WPCF improvements and sewer extensions would ultimately be paid for using a combination of state and local funds. For planning purposes, available state funding for the projects would be in the form of a 2% interest rate SRF Loan, financed over a 20-year loan period. A 30-year loan period may also be possible; however, it could come with a higher interest rate (currently a rate of approximately 2.4% is seen for many communities). Local funds to finance the project will include a combination of funds raised through betterment assessments for sewered properties, sewer connection or capacity fees charged to developers, sewer user charges and possibly limited funds raised through taxation. Sewer Enterprise Fund retained earnings could also be used once a program is established to accumulate such reserves. Sewer rates (i.e., user charges) are distributed proportionately among the users of the system, are typically based on water usage, and would be used to cover the operation and maintenance costs of the completed and improved systems; and WPCF upgrades which benefit all system users may also be partly funded by such user charges.

7.2.2 *Newer SRF Program Provisions from 2016*

Several new provisions were added to the SRF funding program in 2016, as a result of changes to the underlying federal regulations. The most notable of these changes that may impact the funding of Marion's projects include:

- The need to comply with the American Iron & Steel (AIS) Act provisions, which requires construction contracts to include requirements for some iron and steel containing materials and equipment purchased as part of funded projects.
- The need to prepare and maintain a Fiscal Sustainability Plan (FSP) that reviews the financial provisions of the community related to utility management, and demonstrates that the community has provisions in place to provide for the proper funding of system operation and maintenance.
- Provisions for allocating some portion of funds to help with project affordability for communities with lower per capita incomes, with adjustments factored in for unemployment or population change disadvantages.

The affordability assistance provision replaced the previous Environmental Justice (EJ) provision that had previously been in place for SRF funding in Massachusetts. The affordability criteria include a calculation which assigns each community in Massachusetts a rating based on per capita income (PCI), adjusted for employment rates and population trends. Communities where this adjusted PCI falls below the Massachusetts average are eligible for some degree of principal forgiveness in their project funding. The eligibility for principal forgiveness has been allocated by Massachusetts into three categories, with ascending benefits: Tier 1 for communities with less than 100% but more than 80% of the state average adjusted PCI, Tier 2 for communities with less than 80% but more than 60% of the state average adjusted PCI, and Tier 3 for communities with less than 60% of the state average adjusted PCI. The amount of principal forgiveness each funding year is allocated by the Trust to include some fraction of the total SRF funding pool. Historically, this funding has been in the range of 3.3% of project costs for Tier 1 communities, 6.6% for Tier 2 communities, and 9.9% for Tier 3 communities. Based on the recent data provided by the Trust, Marion typically rates at approximately 120% of the Massachusetts average adjusted PCI, and as such is not currently eligible for an affordability incentive.

7.2.3 *American Rescue Plan Act and Infrastructure Investment and Jobs Act Funding Provisions*

Most recently, additional funding has been made available from the federal government as authorized under the American Rescue Plan Act (ARPA) and the Infrastructure Investment and Jobs Act (IIJA). These funding initiatives resulted in the distribution of funds directly to communities to assist with local costs, from which Marion received some funds under APA in 2021. The states also received significant funds under these programs, portions of which remain to be distributed over the next several years. The current expectation is that some additional funds will be available and distributed to SRF funded projects, so being eligible for SRF funding would seem a prudent step for Marion to best provide for funding of its projects. One of the significant factors added to the SRF program by ARPA and IIJA is the Build America Buy, America Act (BABA), which places additional restrictions on the sourcing of raw materials and manufactured products being used on funded projects.

7.2.4 *Other Financing Options*

Other options for financing of public utility projects exist, but significant funds may be less readily available for large capital projects and/or for communities like Marion. Some of these other funding sources include:

- Federal Funding under U.S. Department of Agriculture – Rural Development (RD): Funding of utility projects under the USDA RD program (previously known as the Farmers Home or FmHA program) continues to be available, and includes loans and possibly grants, depending on project eligibility. These programs are targeted at smaller and poorer, rural communities, and eligibility is based on population and income. The current programs likely to be available to Marion (if any) would be less favorable than the SRF funding.
- Utility Rebates: Rebate money is available from the electric utilities for projects that can demonstrate energy savings. As Marion is serviced by Eversource, the electric rates paid by the Town include a contribution which funds rebate programs. It may therefore be appropriate for the Town to pursue a return on those rate investments by applying for funding under the current programs. Some work to be undertaken at the WPCF could result in energy savings. Therefore, rebates present a realistic option to help defray some part of the project costs.
- Specialized State Funding Programs: From time to time, Massachusetts offers incentive funding programs related to special initiatives. The latest examples of this type of program are energy and water conservation incentives, offered through the Massachusetts Clean Energy Center (CEC). In recent years, CEC offered a 'gap funding' program, which helped cover the cost differential between some facility improvements directed at saving energy, and the available rebates that could be recovered for those improvements from the utilities.
- Resiliency Funding Programs: Marion has recently made good use of available funding under State resiliency programs, notably through the use of the Massachusetts Coastal Zone Management (CZM) grant program. This program funded planning and implementation projects for the Town's sewer pump stations, most recently including bypass improvements at the Front Street PS. The Town has also targeted FEMA/MEMA funding programs, including the Building Resilient Infrastructure and Communities (BRIC) and Hazard Mitigation Grant Program (HMGP), to address local resiliency needs. Continued pursuit of these sources is appropriate for a number of the recommended pump station projects that target system resiliency.

7.2.5 *Specific Funding Information for Recommended WPCF Improvements*

The costs of the recommended plan for the Marion WPCF improvements present some financial challenges for the Town. Due to the limited sewer user base available to pay for the WPCF work, and

the continuing debt service from past WPCF projects (including the recently completed lagoon lining project), any significant capital expenditure needs to be considered carefully. The best tool that the Town may employ in implementing the needed WPCF improvements is in phasing the projects for implementation over time.

The availability of SRF funding alone will not make these projects more affordable, though the possible availability of zero percent funds (specifically for nutrient related improvements) could help significantly. The costs to borrow the project capital costs by bonding the total costs and repaying over a 20-year period were calculated for two scenarios:

- All costs are bonded directly by the Town at an assumed annual interest rate of 5%.
- Construction costs are bonded through the SRF program at an annual interest rate of 2%, and ineligible costs (typically including design and administrative costs) are bonded at 5%.

The annual debt service repayment costs for each of these financing options (all assuming 20-year financing period) for the WPCF improvements capital cost is presented in Table 7-1.

Table 7-1: WPCF Improvement Financing

Description of Costs	Local Borrowing @ 5% Interest	SRF Borrwing @ 2% Interest	Total Annual Debt Service (20 years)
Scenario 1 – Local Borrowing			
Total Capital Costs	$ 13 million	N/A	
Annual Debt Service	~$1.04 million		~$1.04 million
Scenario 2 – SRF Borrowing			
Total Capital Costs	$1.2 million	~$11.8 million	
Annual Debt Service	~$0.10 million	~$0.72 million	~$0.82 million

The benefits of the SRF financing are clearly significant when the entire capital cost is considered together. Even greater benefit could be realized if zero percent financing can be obtained for some of the WPCF work. The best option for the Town to improve affordability of the WPCF improvements may be to implement the improvements with a phased approach. This phasing would spread out the expenditures and would allow the Town to address short-term needs first – for example, the phosphorus treatment improvements which will be required by permit. Longer term improvements, such as the additional SBR and related process changes are needed more for capacity, and may be able to be deferred until needed to support the proposed sewer extensions. After review of phasing and other possible funding options, the Town should engage Massachusetts DEP in discussions to support possible zero percent funding for the eligible (nutrient related) WPCF improvements.

7.2.6 *Specific Funding for the Sewer System Extension*

Similar to the WPCF improvements, the recommended sewer extensions may be funded by SRF bonds. Funding requirements are similar, and because of the nutrient management aspects of the sewer extension areas, the zero percent funding could be a possibility for the sewer extensions. The annual

debt service repayment costs for each of the recommended sewer extension areas (for a 20-year financing period) are presented in Table 7-2.

Table 7-2: Sewer Extension Financing

Service Area and Description of Costs	Local Borrowing @ 5% Interest	SRF Borrowing @ 2% Interest	Total Annual Debt Service (20 year)
River Road/Wareham Road Area			
Local Borrowing	$2.3 million	N/A	
Annual Debt Service	~$0.184 million		~$0.184 million
			v.
SRF Borrowing	$0.2 million	$2.1 million	
Annual Debt Service	~$0.016 million	~$0.129 million	~$0.145 million
Planting Island. Lower Sippican Neck & Wings Cove/Piney Point Area			
Local Borrowing	$13.6 million		
Annual Debt Service	~$1.09 million	N/A	~$1.09 million
			v.
SRF Borrowing	$1.3 million	$12.3 million	
Annual Debt Service	~$0.10 million	~$0.75 million	~$0.85 million
Aucoot Creek & Lower Mill Street Area			
Local Borrowing	$7.0 million	N/A	
Annual Debt Service	~$0.56 million		
			~$0.56 million
SRF Borrowing	$0.6 million	$6.4 million	v.
Annual Debt Service	~$0.05 million	~$0.39 million	~$0.44 million

Again, the benefits of the SRF financing are clearly significant. Even greater benefit could be realized if zero percent financing can be obtained, and the sewer extensions are generally expected to be zero percent eligible. Unlike improvements to the WPCF or existing collection system, the cost of sewer extensions are typically paid for (at least in part) by directly assessing the serviced properties – generally by assessing sewer betterments. A challenge with implementing the sewer extensions lies in building local support for the projects - which is tied to the decision making for assigning a locally acceptable fraction of the project costs to individual properties (through betterments). Local cost allocation strategies are discussed in the next section.

7.2.7 *Allocation of Local Costs*

The most likely and significant funding source for wastewater projects are loan programs (e.g., SRF). The lack of significant available grant funds leaves the Town in need of deciding how to raise revenues to repay the debt service from these project loans. In general, there are three significant methods for recovering utility project costs, including:

- User charges and fees (charged to the system users, generally in proportion to actual use).
- Property tax revenues (from general levy taxes charged to all property owners in a community or district).
- Special assessments, including betterments and privilege fees (generally assigned to users on a distributed per unit served basis, but programs vary depending on assessment basis).

The recovery of costs for sewer extensions, as proposed for Marion, often use some combination of these three revenue sources. In Massachusetts, there has been a recent focus on betterment assessments to the properties served by the project to pay the majority (if not all), of the project costs. Where projects convey a general benefit to the community or region, more general local funds to supplement the betterments are often used. Any such costs not included in the betterment assessment amounts need to be recovered through property taxes or user charges (or related fees assessed to users).

For the capital costs included in the recommended plan, the expectation of funding the various projects are summarized in Table 7-3.

Table 7-3: Source of Funding for Recommended Plan Capital Costs

Improvement or Project	General Source of Funding
WPCF Improvements	• User Charges and Fees • Property Taxes
Existing Collection System Improvements (Including Infiltration/Inflow Reduction)	• User Charges and Fees (significantly from I&I fees charged for new sewer connections)
Existing Pump Station Improvements	• User Charges and Fees • Property Taxes
Sewer Extensions to New Areas	• Sewer Betterments • User Charges and Fees • Property Taxes

For the sewer extensions proposed as part of the Recommended Plan, the cost per parcel served is a relevant measure of general affordability (specifically when considering betterment assessments to recover project costs), and must be considered in deciding the best way to allocate the project costs at the local level. Table 7-4 summarizes the approximate cost per parcel served in each extension area.

Table 7-4: Sewer Extension Costs per Parcel Served

Service Area	Approx. Number of Parcels Served	Approx. Cost Per Parcel Served
River Road/Wareham Road Area	~82 parcels	~$28,000
Planting Island, Lower Sippican Neck & Wings Cove/Piney Point Area	~313 parcels	~$44,000
Aucoot Creek & Lower Mill Street Area	~155 parcels	~$45,000

In consideration of past sewer extensions within Marion, and the equivalent betterment charges assessed for those projects, the cost per parcel served for the River Road and Wareham Road project area can be considered reasonably affordable. However, because of the more remote locations of the other sewer extension areas, the higher costs per parcel for these areas appears less affordable. The Town will need to consider supplementing the betterment assessment with user charges or tax funds to ensure local affordability and acceptance of the sewer extensions. Such actions would be reasonable recognizing the general benefit seen by the Town from improved water quality in Marion's coastal waters.

The limited local funding options and the significant project costs bring a question of general affordability to light for the implementation of the CWMP recommendations. Therefore, the discussion of phasing the work is a potentially critical component of project implementation planning. At the current time, Marion's sewer user charges are high in comparison to other communities. A significant part of the Town's sewer user charge costs are being used to repay debt service from past projects (including the original financing for the WPCF upgrades in the early 2000's, and most recently including the substantial costs for lagoon improvements). The Town has a small amount of debt repayments ending by FY2025. A more substantial reduction in debt service will be seen after FY2031, and even more by FY 2035. The ability to defer some new capital cost debt service until these times may be key to limiting the total debt service component of the sewer budget.

7.3 Adaptive Management & Integrated Planning

In moving forward to finalize the CWMP, the Town may look to two key approaches to help guide the implementation of the planned efforts. First, the Town should seek to employ an adaptive management strategy in implementing the CWMP. This approach suggests that the best results can be achieved by implementing changes in measured steps, and monitoring progress to determine what actions are working best. This adaptive management approach then recognizes that the planned actions may be revisited periodically, informed through the measurement of progress made, and then additional action plans can be refined. This means that the CWMP becomes more of a living document, subject to constant reevaluation and optimization. This approach is quite relevant to the proposed WPCF improvements and the sewer extensions, which if not done carefully could over-tax the Town's resources and limit its ability to continue other environmentally or socially important efforts.

An example of adaptive management in the implementation planning can be illustrated by part of the vision for WPCF capacity and its relationship to the recommended sewer extensions. By way of example, the adaptive elements are outlined as follows.

- The Town will seek approval of an increase in discharge capacity for the WPCF under its NPDES permit. This will have the result of increasing the discharged flow from the WPCF, but thereby reducing the net nitrogen in Marion's coastal waters.
- If the NPDES discharge capacity increase is granted, then the Town can commit to extending sewers to the larger areas where nitrogen impacts are key – notably the Aucoot Creek and Lower Mill Street area, and the Planting Island, Lower Sippican Neck and Wings Cove/Piney Point area.
- If the WPCF capacity increase is not granted, the Town will need to defer action on sewering these areas. Sewer extensions will not be an option without additional WPCF capacity, despite this being the best approach to address coastal nitrogen impacts. This result may require additional future changes to the local regulations for individual septic systems, including possibly requiring remedial action to address nitrogen in existing systems.
- In the event that Massachusetts adopts the recently proposed Nitrogen Sensitive Area (NSA) and designates this in effect for any of the watersheds in Marion, additional planning will be needed to determine the best course to address this for affected areas. This likely means revisiting the issue of capacity at the WPCF.

More generally, the initial part of adaptive management approach should be to implement the short-term recommendations of the CWMP, and track the progress in meeting local goals. The WPCF permit capacity and related regulatory aspects are key to this effort, as Marion is still engaged in regulatory consent orders from EPA and DEP. The Town will also need to continue to track general regulatory issues as they affect likely future permit (and more generally wastewater management) requirements. Continued tracking and discussion of ongoing regional planning for wastewater management also plays

a significant role in the efforts going forward. Additional discussions will be need when Wareham finishes their CWMP process, and any new information on regional options and inter-community cooperation will be important to the Town of Marion. This adaptive management approach is an overall important aspect of the recommendations of this CWMP.

7.3.1 *Integrated Planning Considerations*

Another key aspect that the Town should consider is reviewing the needed efforts for all of its water resources projects in coordination with the EPA's Integrated Planning (IP) policy. This policy allows for communities to consider their water resource and environmental project needs collectively and allocate financial resources to the most effective areas. The main focus from EPA's position is the affordability, and projects with cost impacts exceeding the EPA fractions of local per capita incomes can be supported by extended compliance schedules. The longer time to implement needed actions both allows the mitigation of cost impacts over time and allows better access to the adaptive management approaches discussed above.

Based on our preliminary reviews of current costs and incomes in Marion, it is likely that the Town is already impacted by moderate rate affordability issues. In order to best confirm this condition, an accounting is needed of all current costs for wastewater and stormwater activities, and any other activities directed at protecting local water quality. This activity may not be justified by the work needed to complete the current regulatory orders, as such work has relatively limited remaining costs (the large cost of the lagoon 1 improvements are already expended). However, the affordability analysis would be best completed in advance of any additional pending regulatory orders that would require significant expenditures by the Town (for example, any order that would require lining of additional lagoons).

The EPA has prepared new guidelines for assessing affordability over the past two years, resulting in the criteria published in February 2022, *Proposed 2022 Clean Water Act Financial Capability Assessment Guidance*. The guidance retains the theme that a baseline costs generally above 2% of median household income (MHI) may present a moderate to high impact on users. The consideration of lowest quintile MHI data for a community is also still a consideration. The accounting and final use of the new system is somewhat complex and has been subject to continuing discussion. Additional analysis based on these new criteria will be needed to confirm Marion's affordability status relative to the guidelines.

In moving forward to complete the planning process, Marion should review the benefits of adaptive management and relevant integrated planning steps and incorporate aspects of these approaches that can help provide for the best use of the Town's limited resources going forward.

7.4 Schedule Considerations

The schedule for implementation of the recommendations of this report is subject to local approval. Compliance schedule items per the Administrative Order (AO), Administrative Order on Consent (AOC) and Administrative Consent Order (ACO) for the WPCF should be considered.

8.0 PUBLIC PARTICIPATION

This section of the CWMP report describes the stakeholder outreach and public participation efforts included as part of the planning process. The methods of public and local stakeholder outreach are discussed herein, including completed and proposed efforts. Copies of presentation made through the course of the planning work are included in Appendix F, Public Presentations.

8.1 Local Public Meetings and Public Outreach

The planning team, in coordination with the Marion Department of Public Works, provided periodic local updates to the Town of Marion through meetings with and presentations to the Select Board (Water & Sewer Commissioners). Meetings included providing information on the scope and preliminary findings of the planning effort and requesting input from the commissioners and public in attendance on local water resources issues. For many of these meetings, a technical working group made up of key staff and a Select Board representative met to discuss and coordinate key presentation elements before the formal meeting. Notable meetings are summarized as follows, and copies of the meeting presentations are located in Appendix F of this report.

- Select Board – Water & Sewer Commission Briefing – 1/26/2021
- Select Board – Water & Sewer Commission Briefing – 6/24/2021
- Select Board – Workshop on Sewer Needs – 9/27/2021, 9/28/2021
- Buzzards Bay Coalition Meeting – 10/12/2021
- Select Board – Water & Sewer Commission Briefing – 1/13/2022
- Select Board – Water & Sewer Commission Briefing – 4/11/2022
- Select Board – Water & Sewer Commission Workshop – 7/20/2022
- Select Board - Water & Sewer Commission Workshop – 1/10/2023

Each of the Select Board meetings were recorded and posted on Old Rochester Community Television and were available for later viewing.

8.2 Coordination with Town Departments and Citizen's Advisory Committee (CAC)

The Town sought to better engage public input for the CWMP process through the formation of a Citizens Advisory Committee (CAC). The membership of the CAC included representatives of key local boards (such as the Board of Health) and citizens representing the general public. As with the Select Board briefings, technical work group meetings were held before each CAC meeting to support staff discussions and coordinate presentation content.

The formal CAC meetings included the following:

- Introduction to the CWMP (CAC Meeting 1)– 2/24/2021
- Existing Conditions & Needs (CAC Meeting 2) – 3/24/2021
- Alternatives Screening (CAC Meeting 3) – 5/19/2021
- WPCF Tour (CAC Meeting 4) – 7/7/2021
- Final Alternatives for Sewer Needs Areas (CAC Meeting 5) – 8/11/2021

At the conclusion of the last CAC meeting, the group was asked for recommendations to the Select Board. Specific CAC input on the plan for extending sewers to needs areas were discussed at the Select Board meetings in September 2021.

The planning work has included a process of data collection and coordination of information on ongoing and planned initiatives in Marion. In addition to public meetings, this coordination has included meeting and corresponding with various Town departments to best capture the innate knowledge of the Town staff. Specific meetings and coordination have occurred with the Select Board, Town Administrator, Water and Sewer Department, Health Department and Planning Board.

8.3 CWMP Review Public Hearings

A public meeting was held on May 23, 2022, to present the draft CWMP to the Marion public. This meeting was held in person at the Music Hall, and also made available to remote viewers via a Zoom meeting platform. A copy of the presentation materials from the public hearing included in Appendix F. This meeting was recorded and posted on Old Rochester Community Television.

The draft CWMP document is being posted to the Marion website and a final public hearing will be held, where public comments are accepted. The CWMP will be issued final following review and, as appropriate, response to substantive comments.